OCTOBER 24, 1936

ELECTRICAL WORLD

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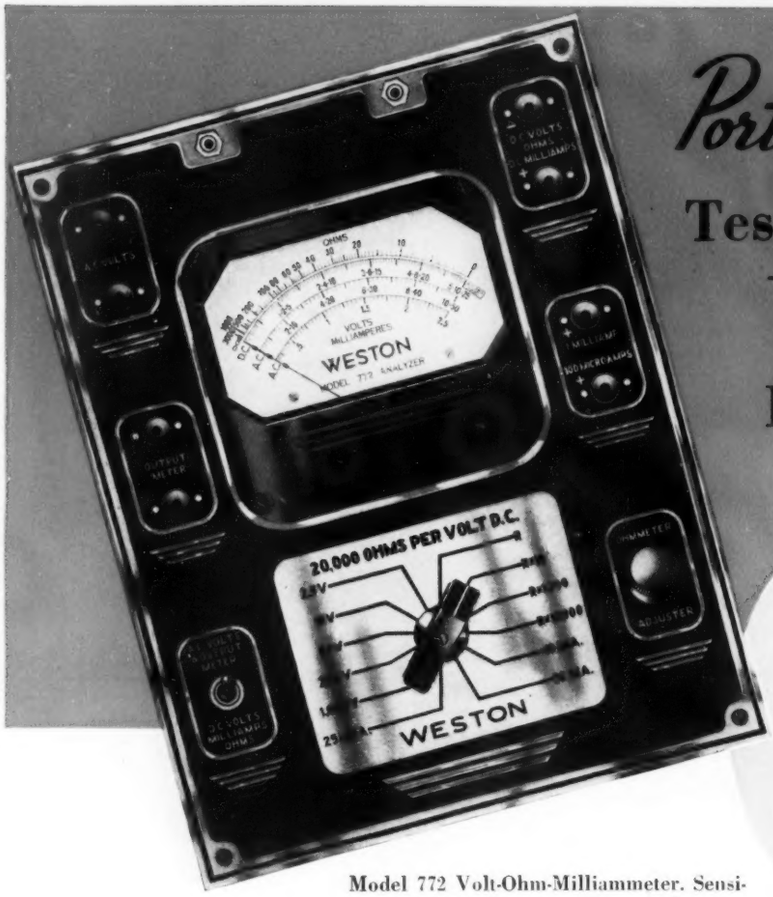
Industry Electrifies to Modernize



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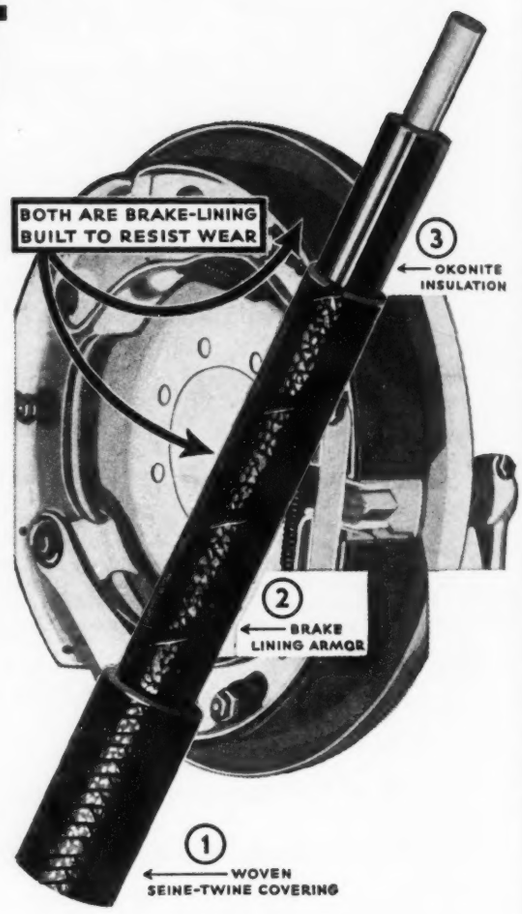

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Letters TO THE EDITOR

Questions Grand Coulee Figures

To the Editor of ELECTRICAL WORLD:

Reference is made to the article by Frank F. Fowle on "The Nation's Power Supply" in the June 20, 1936, issue of the ELECTRICAL WORLD.

I was extremely interested in the article, coming as it did from the pen of such a well-known engineer. However, the errors or misstatements in Tables XIII and XIV (particularly the data on the Grand Coulee project) caused me to lose faith in the remainder of the article.

The figures of ultimate cost as given in these two tables for the Grand Coulee project are doubtless for the power project combined with the irrigation project, this latter involving the irrigation of about 1,200,000 acres of what is now arid land. The "public development" cost of the Grand Coulee power project as given in the Army Engineers' report (page 748, House Doc. No. 103, Vol. II, 73d Cong., 1st sess.) is about $171,000,000, and of the irrigation project is about $222,000,000 (page 974 ibid.), both figures including interest during construction. Thus, the total of these two figures is $393,000,000. The Army Engineers based their costs on the installation of 1,550,000 kw. It is understood that later cost studies by the U. S. Bureau of Reclamation were based on an ultimate installation of 1,865,000 kw., this being the figure for "ultimate output" used in Table XIII. The Bureau of Reclamation's cost figures were in substantial agreement with those of the Army Engineers.

The figures on "Initial" and "Ultimate" capacity given in Table XIV are now meaningless, based, as they probably are, on the provision of the original contract between the Bureau of Reclamation and the contractors building the so-called "low" dam. That contract has now been modified to provide for construction of the base only of the ultimate dam, with no provision for the installation of any power equipment. Furthermore, still referring to Table XIV, the "Ultimate cost" there given is for the ultimate high dam project plus irrigation, but the cost per kilowatt has been based on this total cost and the capacity for the low dam, giving a cost per kilowatt of $649, or about six times the unit cost ($108.70) given by the Army Engineers for the high dam power project alone.

I suspect that the entire cost of the Fort Peck project has likewise been charged against the power development, whereas flood control and navigation are also essential elements of the project and should bear proportionate shares of the cost. (See House Doc. No. 238, 73d Cong., 2d sess.)

Mr. Fowle may say that he accepted the data furnished by the U.S. Chamber of Commerce without checking the accuracy of those data. Should not Mr. Fowle have checked these figures before using them, so that the article would have presented facts and not merely figures colored for a particular object?

This letter is written purely in the interest of accuracy.

EUGENE I. PEASE,
8232-16th Ave., N.E.,
Seattle, Wash.

Mr. Fowle's comments follow:

The letter from Mr. Pease is interesting for several reasons. In the first place it confirms the over-all figures compiled by the United States Chamber of Commerce on the Grand Coulee project.

The matter of deductions or allocations for such benefits as navigation, flood control and irrigation was mentioned in my paper. If Mr. Pease will consult the June issue of the *Journal* of the Western Society of Engineers, where my paper appears in full, I think his criticism will be answered. Furthermore, I would recommend his consideration of the U. S. Chamber of Commerce report on "Water Resource Policies: National and Local," released last March.

It is most fortunate indeed that the Grand Coulee project has been modified, as Mr. Pease states, to exclude the installation of any power equipment. At Fort Peck there is also no provision for any power development, under the modified plans at present being carried out.

FRANK F. FOWLE.

•

An Oversight in Pension Plan

To the Editor of ELECTRICAL WORLD:

Many of our public utilities have transferred the operation of their pension system to outside concerns. While this is advantageous to the younger employees, it does not work out so well for the older ones who in the early days worked longer hours for lower wages.

To adjust for this oversight and secure more adequate pensions for these old and pioneer employees of the "Edison industry," it is proposed to add a minimum proviso, so that all employees who were with the company prior to the inauguration of the new retirement plan shall receive at least this minimum upon retirement, except those whose positions pay less than this amount may be retired on full pay. For the larger and more prosperous companies $100 per month is proposed as a normal minimum.

It should be noted that an adequate pension system commensurate with the nature and rating of "Edison industry" acts as a great stabilizing force in the community, improving business and economic and social conditions, and reflects the friendly and constructive motive behind it—to the credit of the company.

R. S. WHITE,
2011 F. Street, N. W.,
Washington, D. C.

•

Queries About Added Lighting Demand

To the Editor of ELECTRICAL WORLD:

I have been studying with much interest the campaign for "Better Light—Better Sight" which is being carried on so splendidly by your paper. There is only one point which I feel has not been touched and it may be a very important one. When I see that you forecast a possibility of trebling lighting kilowatt-hours (which is, as a matter of fact, a conservative ratio) I wonder whether it will be possible to sell all of these kilowatt-hours at a digestible price.

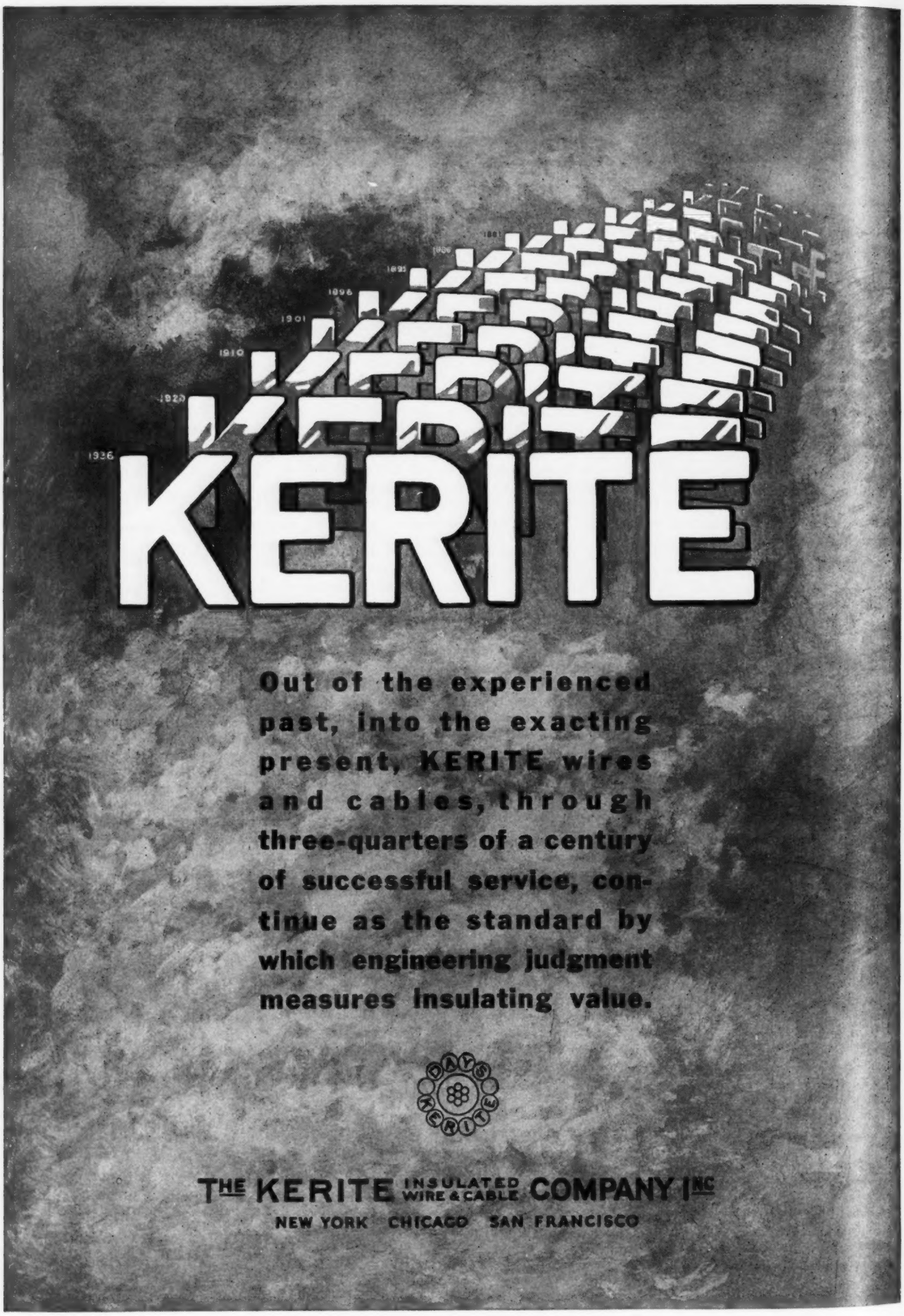
The greater part of this new lighting load must, necessarily, be peak load, without a very great chance of counterbalancing this amount of peak load.

In other words, glad as the electrical manufacturing industry would be to find all these new orders for increasing central stations, I cannot quite see how a public utility man can find the interest and amortization for this very heavy new investment in the face of the present world-wide movement for cheaper unit prices.

I cannot imagine that a paper like yours has overlooked this problem and I shall be very keen to hear your answer, either in one of your next issues or by way of a letter.

R. KAUFFMANN,
Representative *Electrical Service*,
High Holborn, London.

[Generally speaking, appliance loads have been well enough cultivated to absorb the additional lighting demand that comes on in response to the "Better Light—Better Sight" movement. And there is no let-up in the effort to enhance the non-lighting load, so the measure of good household load factor already attained is held. Beside these items is the fact that much of the gain in lighting load is made with customers who are not yet using enough energy to earn the lower rates of the follow-on-blocks.—EDITORS.]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ELECTRICAL WORLD

OCTOBER 24, 1936

Back on the Track

Politics holds the limelight. Newspapers are filled with speeches and propaganda. The candidates are rushing toward the finish line. Hidden here and there, however, are happenings that are tangible and news items that give encouragement to the electrical industry. Business is better and prospects are improving daily.

And industry psychology has changed. Visits to recent meetings of utility and manufacturing representatives show that the pessimists have been overcome by the facts. All agree that troubles are minor and that business opportunities are major. No one remains a pessimist about the future of the electrical business. There is courage and there is optimism.

Getting down to business is the program of the industry these days. Manufacturers, without exception, are making sales bogies for 1927 much larger than those recorded in 1936. They are busy with purchasing, organizing and selling to meet or exceed these bogies. They face Robinson-Patman, Walsh-Healy and other recent legislation that may affect their operations, but they are going ahead unafraid. They believe in the future and in the ultimate fairness of government.

Utilities face large capital expenditures for next year. All their facilities must be amplified and extended to serve unprecedented loads. Executives face the problem of raising new capital, in the order of at least a billion dollars. Bond money is cheap and abundant, but a well-balanced capital structure necessitates the sale of junior securities. We believe these will be in favor next year because no industry is in a sounder position to go ahead and make good earnings. Investor favor follows facts and not opinions.

There is still a political situation and a legislative condition for utilities to face. But here again the psychology has changed. The industry has placed these matters in better perspective. It is putting its attention on finance, organization and sales to improve its business position. It has ceased putting its entire attention on Washington. It now has faith that justness and fairness will prevail and has gone ahead with plans to earn its own salvation on sound foundations. We believe the wave of political persecution of utilities has reached and passed its peak. It is now reduced to court actions, very largely. It was an uncalled-for manifestation of the psychology of depression.

An encouraging sign of a better spirit in the industry lies in the development of many joint programs to get more business. Teamwork is becoming apparent as never before. Joint work on light, kitchen modernization, ranges, refrigerators and water heaters is now being applied to many aspects of the domestic market. Industrial plants are modernizing by electrifying. Utilities and manufacturers are putting their heads together to get business. And they are putting up money to support the programs. This is a sure sign of confidence in the future that is not based on merely political froth.

Surveying the situation in terms of facts and trends, there is a glowing opportunity for business increases. But we place an equal value on the fact that the industry now has an optimistic mental attitude. These two conditions are at work to make it go forward.

Editor.

Photo by Norfolk & Western Ry.

COAL PIER EFFICIENCY RESTS ON ELECTRIFICATION

Capable of handling forty 120-ton cars or fifty 70-ton cars of coal an hour is this Norfolk & Western Railway Company pier at Norfolk, Va. Extensively electrified, the pier has an electric pusher that moves cars up an incline to the dumper, where it is spotted on the cradle by a pneumatic retarder. Electric boat haulage machines on each side of the dumper move the vessel back and forth as necessary, while four electric capstans, two on each side of the dumper, handle mooring lines and hold the ship against the pier. Cargo loading and bunkering are simultaneous and neither operation interferes with the other. Coal is loaded from the barge to the ship by means of an electrically operated bucket hoist and chute arrangement.

Industry Electrifying in Many Big Strides

Round-up of Recent Accomplishments Reveals That Electrification Is in a Fresh Ascendancy Over Inertia and Competitive Methods

By
ARCHER E. KNOWLTON
Associate Editor

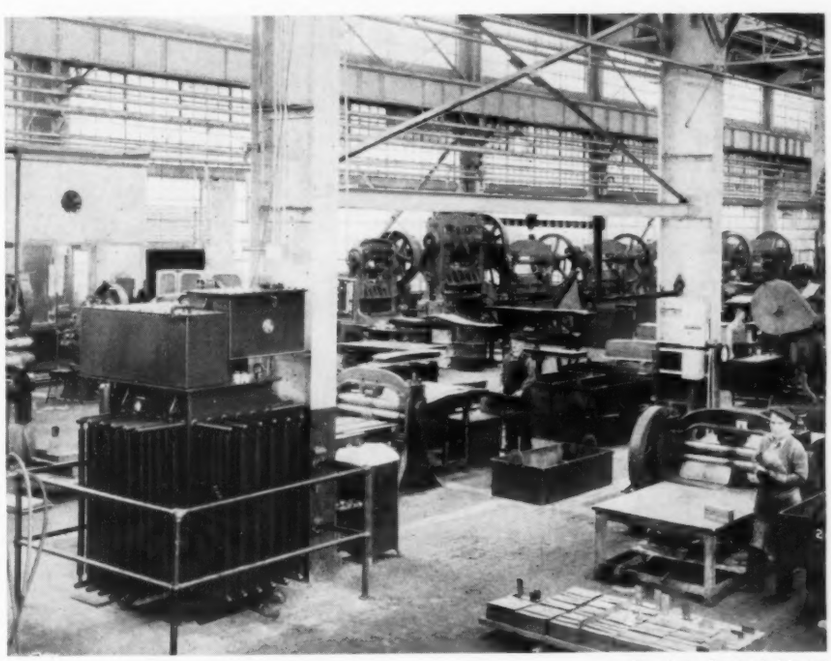
SUCH business recovery as there has been has started a wave of industrial modernization which, in these days, means more intensive electrification. Competition is keen and the electrical way is more than ever offering an economic advantage. Gains from application of electrical energy are increasingly numerous and convincing.

As for the handling of power, manufacturing plants are tending toward higher voltage at the purchase point, higher intermediate voltages, more strategically placed substations and higher voltages at large motors and furnace transformers. This is creating large savings in secondary distribution and it is moving into these plants the equipment that has been methodically developed for utility systems — unit type substations, metal-clad switchgear, high-capacity fuses and breakers, rectifiers, capacitors, etc., just to mention a few. Cubicled outdoor substations are releasing valuable indoor production space.

Distribution and control

One marked trend in distribution is the adaptation of the electrical scheme to the flexibility needs of the modern production-line idea. There is a disposition to view the control equipment as something that need not be at the driven machine even though the motor must be there. It can occupy unproductive space elsewhere, especially if intricate and bulky. In some instances, where the operator works at the machine, the control devices are being collected at unit panel assemblies at some pillar, mezzanine or wall location and the buttons stay at the operator's finger tips. This makes for flexibility in wiring changes when machines are rearranged for different production. It also permits maximum use of feeder investment. In other instances, where the operator can best control operations from a central location, the master-actuating devices are located there and the contactor, emergency and protective devices may be left associated with the motor. Further adoption has been made of trolley schemes for serving high-frequency and other portable tools alongside production lines.

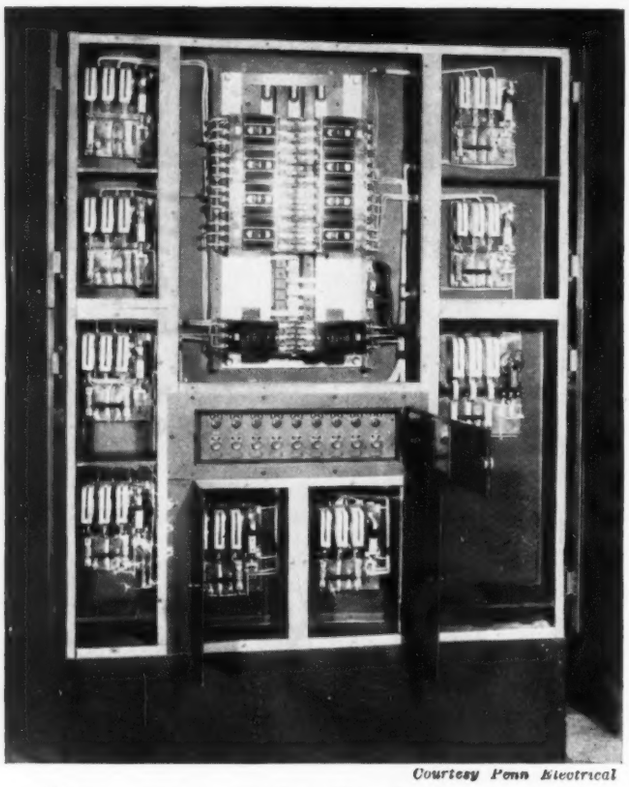
More recognition is being given to the fact that poor load factor makes power costs run high. This means that operations are more and more being controlled so as to fill valleys and limit peaks. Processes that can be interrupted are scaled down by electrical control so that essential operations can occur without occasioning abnormal demands. Still other aspects of new control rest in the resort to electronic tubes to regulate speeds of component parts so that stretch or



Courtesy General Electric

Railing replaces vault as transformer guard

Non-inflammable, non-explosive liquid for insulation and transformer cooling permits locating substation in factory space where distribution economies may be optimum.



Courtesy Penn Electrical

Motor controls centralized like distribution panel

pile-ups will be averted, to register cutting of labels and wrappers, to time spot-welding and regulate speeds in refined degree. Rectifiers are in increasing use to permit continuance of d.c. for magnetic clutches, adjustable-speed motors, etc.; controls have been devised to regulate the rectifier output to close limits where needed. New controls are also available to regulate furnace input for close holding of temperatures. A new "staggering" control has been applied to avert cumulation of peaks where several reciprocating pumps or compressors may start simultaneously.

Instrumentation and protection reflect advances

Signs point to the increasing use of electrical instruments in industrial establishments. However, not much more than a start has been made to give the production manager on a panel before his desk a comprehensive view of operations and production in terms of kilowatts, kilowatt-hours, speeds and other electrical quantities or indexes. One machine tool manufacturer has sensed this trend and equips his lathe head with meters to show the input and thus tell the operator how to handle the machine for best output. Ultimately, this objective should be extended to the battery of machines, whole departments and the conveyors that link them into a production stream. Time devices that regulate the duration of repetitive operations and others that totalize these durations are coming into vogue. So are meter assemblies for the aid of the plant engineer in making load studies of motors and circuits.

On the protection side the industrial plants, like the utilities, are making comparative studies of fuses and breakers with the objective of choosing the more economical at each point by taking advantage of the new features that have been introduced into them. Time-lag fuses may eliminate outages on surges that would blow an ordinary fuse. Snap switches with an overload tripping device can, at times, replace fuses to advantage. Recent designs of breakers are offering substantial savings in space, along with the advantage of prompt service restoration, which is especially important in the larger ratings. Metal-clad switchgear has been introduced for progressively lighter service.

The attached motor is yielding steadily to the built-in motor and the built-on motor whose flange attachment greatly facilitates maintenance and substitution. Motors generally have not ceased their movement toward speed range (through gears, frequency changers, or other schemes) that gives flexibility in the existing application as well as in transfer to other applications. The general-purpose motor is holding its own, but all along the line the current trend is toward making the motor the servant of optimum production, no matter what it has to be as to slip, torque and speed range, protection from its environment or protection of the process and equipment against hazards of fire and explosion. It takes only a small loss in production to cover the complete cost of driving equipment. Also, it takes only a small increase in production to justify considerable increase in the cost of the controlled drive or to offset certain losses which may be incurred in attaining the desired characteristics.

Electric heat

Alloys with better properties and better products from simple metals are parallel activities which are expanding the use of electric heat in furnaces and heat treatment ovens. Cast iron is making a revival on this basis after inroads made by alternative alloys and by the welding of fabricated assemblies. In one instance the adoption of a 2,500-kva. furnace clipped $4 off the cost of preparing ingots for the rolling mill. High-frequency melting has solved problems in making magnet steels. New in the furnace field is one which replaces the arc by radiant heat from a carbon resistor raised to incandescence. Metallic resistors have been extended up to functioning at 2,300 deg. F.

The controlled atmospheres possible with electric heat have opened new opportunities for safe processing and superior quality of product. Strip heaters are finding a multitude of new applications. When coupled with automatic control, they allow the attended day-time jobs in distillation plants, for example, to be shifted to night operation at off-peak rates. Oil-drilling tools have been heat treated electrically at a cost of 4.3 mills per pound in two box and two drawing furnaces in one Western establishment.

Variable-speed motors are making heat-treating set-ups so flexible that widely different materials can be passed through with full attainment of production-line regularity. Plastics and cellulose products like cellophane are being processed with minimized fire risk by comprehensive resort to electric heat. Vulcanizing applications are likewise expanding.

Electric steam generators have broken into an increasing number of applications. In making steam for molding bakelite one plant saved $2,400 in a year by substituting four 10-kw. steam boilers for oil firing.

Lighting and air conditioning

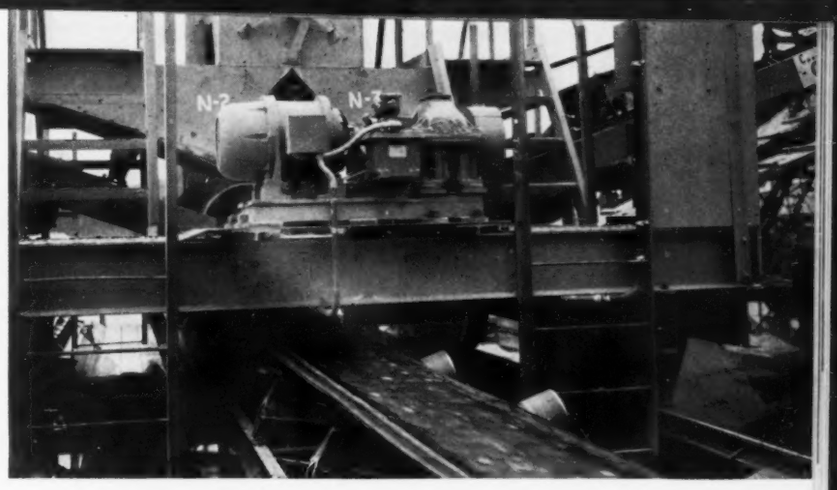
In keeping with the "better light" activities of the electrical industries

general productive industry is adding lumens for the sake of efficiency, safety and vision preservation. A chocolate factory and a silk hosiery mill constructed windowless buildings which maintain daylight simulation at or above 30 foot-candles and have complete air conditioning as well for the aid of the process and of the employees.

The former installation shows less over-all operating cost than windows would have entailed. Revamping of certain factory layouts has resulted in such changes, for example, as using former production areas for draughting rooms. Here enhanced lighting is the large factor which makes the change feasible. Paint is a partner in many of these uplifts.

Air cooling and humidity control for industrial establishments has not yet gained the momentum that it has for commercial spaces. It is, however, steadily finding its place as an indispensable adjunct to process refinement just as electric heat with or without constituted atmosphere has done.

Further, there is the call to protect the health and comfortable efficiency of employees not only in mass but in the isolated instances where single operators (e.g., a crane operator handling large masses of hot metal) are subjected to extremely enervating conditions. In the River Rouge foundry of the Ford Motor Company the workers at the molding machines breathe clean, cool air free of dust and smoke, thanks to air conditioning, which washes out 42 tons of dirt every week from the foundry air.



Motors today no hothouse plants

The motor is going outdoors with a vengance and thus doing its part in the revival of building of structures and highways. This totally inclosed motor drives the conveyors of an aggregate plant.

Courtesy Westinghouse

Pumping, dredging, material handling

Resumption of construction operations, sustained activity in oil fields and improvement in centrifugal pump efficiencies are all factors which have expanded motor applications to pumping jobs. Over-all efficiency of 87.5 per cent from wire to water has been obtained in a pumping station that handles 28,000,000 gal. per day. And in spite of the handicap of building a line and setting transformer to serve a deep oil well pump, electric drive is establishing itself economically in the oil fields.

Many new dredging jobs, such as for gold extraction operations and for channeling, are being done by electrically operated dredges. Huge shovels for such operations as coal stripping are electrically driven. Temporary concrete mixing plants are increasingly motor powered. Conveyors, motor driven, are taking their place in construction work to move materials more expeditiously for the same reasons that they are prominent in industrial operations.

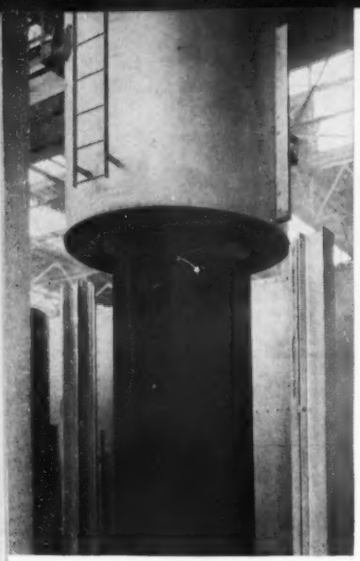
Industrial battery-driven trucks have new vertical range obtained through telescoped uprights. Heavy loads (even one-ton newsprint rolls) are readily handled in congested space by late designs of trucks. At docks electric unloaders are transferring cargoes expeditiously to shipside freight cars. In freight terminals battery-powered tractors are handling coupled trailers in trains that keep freight moving because it is always on wheels and never "set down."

Electric heat for the job, meters for the check-up

Power factor

While both utility and industrial plants had a large excess of generating and distribution capacity the incentive to install power-factor corrective apparatus was much reduced. Now that loads are approaching the fair limits to which these facilities can serve there is a pronounced tendency to revert to the old program of installing capacitors, synchronous condensers and other measures for holding the voltage, working the circuits effectively by localizing the reactive interchange and getting the best performance out of the electrical utilization equipment.

The pictures herewith show just a smattering of what is going on all through industries intent on rehabilitation according to the 1936 pattern. The real story is told in the accompanying articles, long and short, which feature this issue.



Lifting off a bell

Ford Anneals Steel Strip With Electric Heat

Largest Installation of Electric Furnaces for Controlled Atmosphere Annealing Sheet Steel Is in Rouge Plant of Ford Motor Company—Each of 26 Bell Type Furnaces Has Three Stands for Continuous Operation

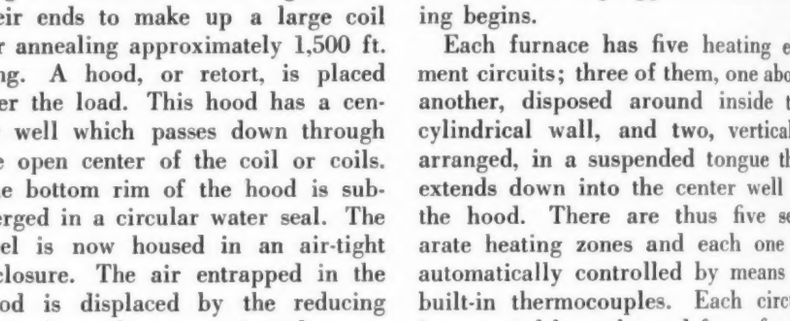
LIKE a platoon of soldiers standing at attention in double rank stretches the long perspective of the bell type electric annealing furnace installation in the Rouge Plant of the Ford Motor Company. Here hundreds of coils of strip steel are daily annealed to remove the internal stresses left in the metal by the rolling process. This must be done before the steel is cut and pressed into the many and various forms used in the assembly of the Ford car. The steel is heated to about 1,400 deg. F. and slowly cooled down to around 200 deg. in a reducing (oxygen deficient) atmosphere, emerging clean and bright and ready, after a final light temper roll, for the forming presses.

There are 26 furnaces, each one with three stands, the 78 stands thus required divided into four groups, three of 18 stands and one of 24. The two groups in the south side of the installation, twelve furnaces, were supplied by the Westinghouse Electric & Manufacturing Company and the fourteen in the north half by the General Electric Company. Except for minor differences in design, however, the furnaces are identical and the description of operation given here applies to both makes.

A stand is loaded by placing upright on it one or more coils of strip, the complete load not to exceed 96 in. in height. Depending on the width and gage of the steel, a single coil from the rolling mill may contain up to 500 ft. of strip. Usually three single coils are welded together at their ends to make up a large coil for annealing approximately 1,500 ft. long. A hood, or retort, is placed over the load. This hood has a center well which passes down through the open center of the coil or coils. The bottom rim of the hood is submerged in a circular water seal. The steel is now housed in an air-tight inclosure. The air entrapped in the hood is displaced by the reducing atmosphere for approximately one-half hour. A horizontal centrifugal fan in the base is then turned on for fifteen minutes to clear out any entrapped air. The fan is then shut off and just enough of the reducing gas is maintained in the cover to overcome outside air pressure. Now a crane comes along and lowers the bell furnace over the hood, the electrical connections are plugged in and heating begins.

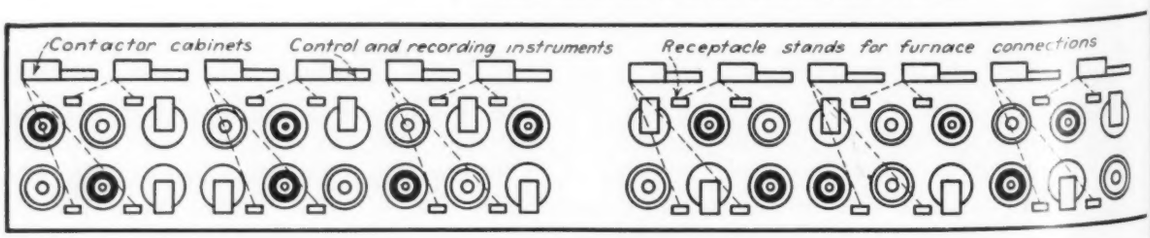
Each furnace has five heating element circuits; three of them, one above another, disposed around inside the cylindrical wall, and two, vertically arranged, in a suspended tongue that extends down into the center well of the hood. There are thus five separate heating zones and each one is automatically controlled by means of built-in thermocouples. Each circuit is protected by a thermal fuse of gold wire to guard against failure of the automatic control. The total capacity of the five circuits is 230 kw. at 220 volts.

The reducing atmosphere in which

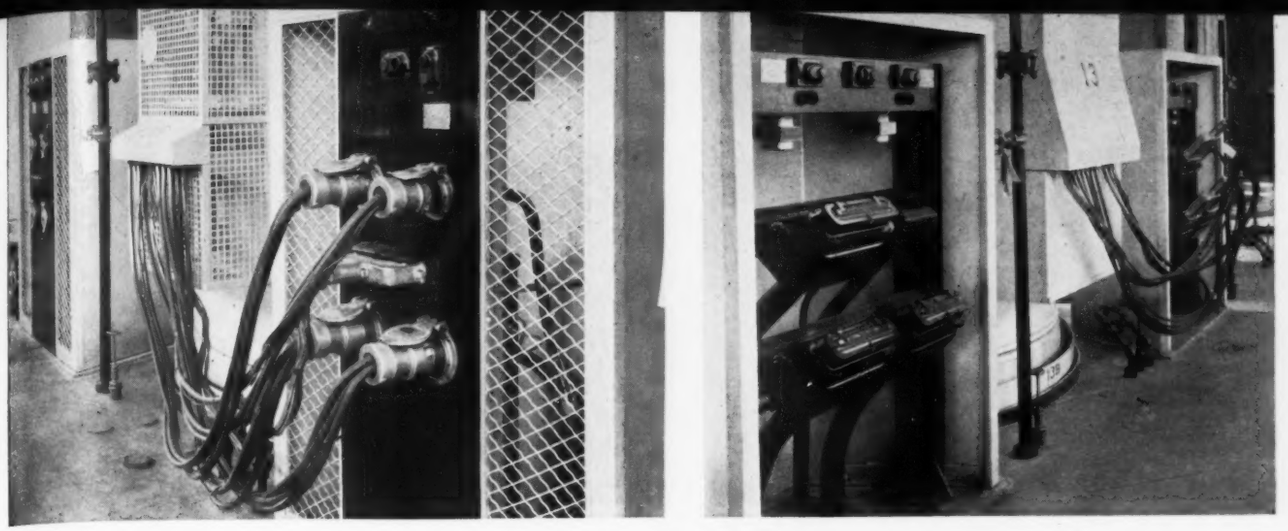

Coils of strip to be annealed
Fan for circulating gas
Water seal
Hood placed over coils
Bell with heating elements arranged around inside wall and in tongue suspended in centre
Leads

A furnace unit

At the left is a stand loaded with two coils of strip. In the center the hood is in place and at the right the furnace placed over all.



Layout of stands, receptacles and control equipment

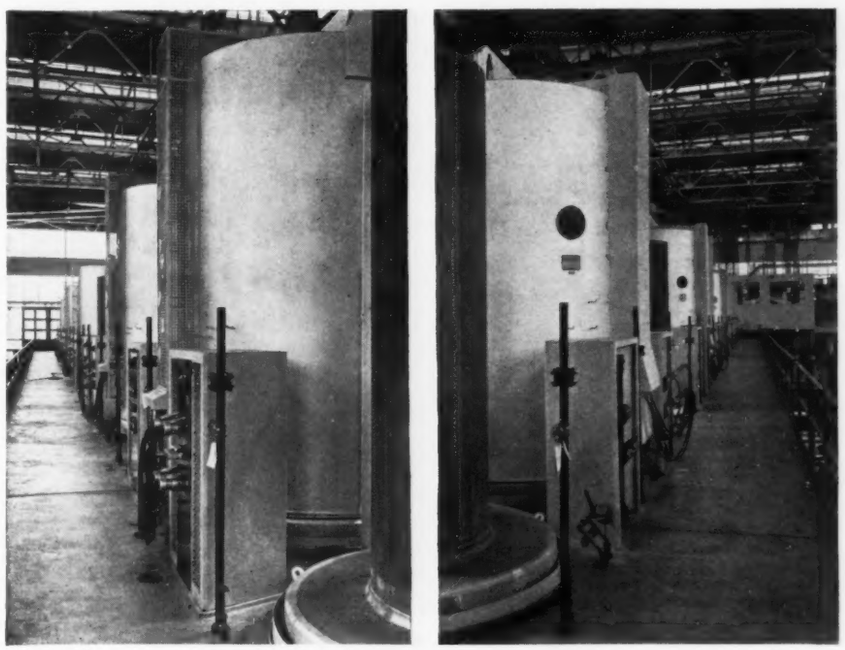


Somewhat different receptacles

One furnace maker likes a round plug and the other prefers one with the contacts in line. Except for slight variations in furnace design, the connection devices and the nameplates are the only means for distinguishing one make of furnace from the other.

the steel is annealed is supplied from a furnace atmosphere controller which takes in ordinary coke oven gas and air and by means of partial combustion turns out a mixture of about 72 per cent nitrogen, 15 per cent hydrogen, 8 per cent carbon monoxide, 3 per cent carbon dioxide and 2 per cent methane. If the steel were heated in an atmosphere of ordinary air inside the hood there would be considerable oxidation of the surface at the high annealing temperature. It is in an effort to prevent this that the reducing atmosphere is used. There are three of these furnace atmosphere controllers in the Ford installation, two with capacities of 2,000 cu.ft. of gas per hour and one of 1,000 cu.ft.

The time period of an annealing cycle depends on the characteristics desired in the softened steel. If the sheet is to be used in shallow draws without sharp angles the steel may be comparatively hard and the time of annealing correspondingly short. But if the draw is deep and contains sharp corners, as in a fender, then the metal must be much softer, the product of a longer annealing time. The heating bell may remain in place over the hood from six to twenty-one hours. The ratio of heating to cooling time is usually taken as 1 to 1.75. Thus the complete annealing cycle will range from about 14 hours to 35 hours. This is why three stands are provided for each bell; while the steel on one stand is heating the coils on the two others are cooling and the furnace is kept working all the time.

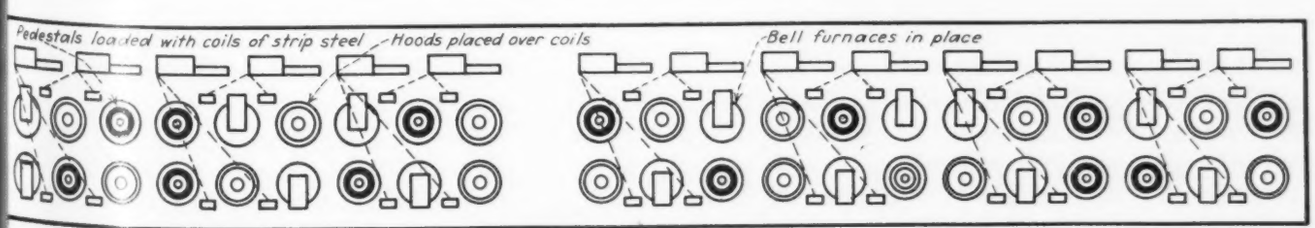


Drawn up in company front

These pictures were taken at about the center of the line. At the left are the twelve Westinghouse furnaces and at the right the fourteen General Electric.

Because of the variation in desired characteristics of the annealed steel it is not practicable to state any definite output capacity per furnace. However, it may be said that over a long period of operation production will average out to around twelve to sixteen tons of steel per unit for a 24-hour operating day. When ambient temperature is high or when it is otherwise desired to accelerate the cooling period a perforated pipe ring

[*Continued on page 70*]



Combination mercury-tungsten units provide intensified local and even general illumination in die department

Bliss punch making field straps

No local tungsten unit is needed, the entire machine being provided with adequate light from a fixture hung 90 in. above and 3 ft. in front. The operator becomes his own inspector under these favorable conditions, with no eye strain.

60 Ft.-Candles

Refined Clock-Part Production Demands More Light and Less Shadow

WHEN the Warren Telechron Company recently expanded its factory at Ashland, Mass., equipping a plant 100 ft. long x 50 ft. wide for die making and punching operations, it was important to provide higher intensity lighting, with a minimum of shadows, than had previously been enjoyed by this busy establishment. The company produces a varied line of electric clocks and special deviecs for synchronizing generating systems and equipment controls. These involve the processing and assembly of many small parts, including high-grade die making and accurate machining operations performed or supervised by skilled labor. Light of first-class quality and of adequate supply is therefore a vital necessity.

The new section of the plant is located about a mile west of the original shops and is equipped with 63 General Electric Cooper-Hewitt mercury-vapor combination incandescent units, the installation being the first in the country. Of these, 51 are of the rectangular type and twelve of the circular type. Each is rated at 475 watts total, of which 275 watts is consumed by the mercury-vapor tube section of the lamp. The rectangular lamps cost $36 f.o.b. Hoboken, N. J., and the circular units $33 each. It is estimated by the manufacturer that such an installation will pay for itself inside of about two years if the improved lighting saves two minutes per operator per hour, or about the time required to obtain a drink of water. This includes amortization, energy charges and maintenance.

The Warren organization was unable to give a figure for the value of the improved lighting, for the reason that when the new building was occupied the machinery transferred was rearranged for better production, along with the great improvement in illumination. However, the plant officials stated that the modernized lighting is an important factor in securing production increase and in lessening the number of rejects in processing, and as an initial level of 60 ft.-candles has been obtained on working planes, the results have been highly satisfactory from the start. The Warren company has decided to equip a portion of its other plant with this type of units on the strength of the performance obtained in the new plant.

"Electrical Skylights"—The units installed at Ashland are designed to provide an unusual degree of flexibility in application. The rectangular units are each equipped with four sockets capable of accommodating up to 150 watts per socket for incandescent service (tungsten lamps). The mercury tube is 33 in. long x 1 in. diameter and the over-all length of the fixture is about 50 in. This provision for different sizes of tungsten lamps enables the user to obtain the required intensities through a varied range of heights above the working plane. As the proportion of incandescent lighting increases, the color values approach daylight quality more and more closely. Reflectors are of the latest type of "Alzac" aluminum, designed for extreme hardness and untarnishability. The diffusing glass is a special imported German make, treated with hydrofluoric acid and of crystal clarity. The units do away with the need for skylights. Color corrections can be made by adding more light instead of by subtract-

Stimulate Factory Output

Mercury-Incandescent Combinations in First Industrial Lighting Service

Surface grinder illuminated from above

No time is lost through shadowing of work or delayed adjustments due to poor lighting.

ing light through the use of filters.

At Ashland the rectangular units use four 50-watt lamps each in addition to the mercury tube. These units are installed in general above the machines served, but in some cases at one side and in others directly overhead. The circular type units, employed in the general lighting of areas in this case, less intimately associated with machine operations, utilize a 200-watt tungsten lamp with the 275-watt mercury tube, the fixture diameter being 20 in. Even the general illumination approximates 25 ft.-candles in the areas served by circular units.

Battery of "kick" presses on mezzanine floor lighted by two Cooper-Hewitt combination units

Note uniformity of illumination

Field coil assembly 5 ft. 6 in. below combination lighting unit

Die Department Lighting—The new plant has a bay 70 ft. long x 12 ft. wide devoted to die making, and this department is equipped with seventeen rectangular units mounted 7 ft. 6 in. above the floor. Along the left-hand side, as shown, are ten special benches projecting into the aisle, and above these are mounted seven lighting units with axes at right angles to the longitudinal axis of the aisle. The other units in the department are mainly installed with axes parallel to the walkway. The benches referred to are about 33½ in. above the floor and are spaced 8 ft. apart on centers. To provide for special illumination required when the die maker looks between die faces in fitting work (the faces may be 1/32 in. apart and 1 ft. square) a 40-watt tungsten lamp is installed at each bench on a flexible arm, but practically all the other illumination of the department is furnished by the Cooper-Hewitt units. The various machines along the right-hand side of the aisle are provided with light from the overhead units shown. The absence of shadows, sharpness of detail available and uniformity of lighting flux provided are outstanding features of the departmental illumination.

General Lighting—General illumination is furnished by circular type units hung 13 ft. above the floor, on 20x20-ft. centers with a fifth unit in the center of the square.

Special Applications—Adaptability of these units to individual machine locations is well illustrated by the accompanying views.

Modernizing Pays Way at Bleaching Plant

Paper Mill Treats Quarter More Pulp With Fifth Less Energy — Speed Reducers Are One Major Factor

By D. F. CRONIN . . . R. E. TERRY

Plant Engineer
Cherry River Paper Co.
Richwood, W. Va.

Westinghouse Electric & Manufacturing Co.
Fairmont W. Va.

STRIKING study in contrasts was presented in the Cherry River bleaching plant after the modernization of its four 2-ton pulp bleachers. Revamping of these bleaching machines resulted in cleaner stock, no lost time, increased production, savings in power and the elimination of the high cost of maintenance on the old type of drives. The efficiency of the bleaching plant has been greatly increased. Twenty-five per cent more pulp can now be put into tanks with an actual saving in power. With this increased capacity meters in the motor circuits show that 20 per cent less power is being consumed than was required with the original drives. The savings made in one year more than equaled the total cost of replacing the open type gearing with the inclosed gearing units.

Bleaching vats are used to bleach the pulp to a snowy whiteness before it goes to the beater room and thence on to the main paper-making machines. There are countless uses for pure white papers such as writing paper, envelopes, index cards, food containers, etc. All slight discolorations, spots or specks of any kind in such paper are causes for rejection by the converting plants which use it. The wood pulp as it comes from the cooking process is from a light gray to a dark brown color. To remove all this color the pulp or stock is agitated in a hypo-chloride solution for about 2½ hours. Fourteen hundred gallons of bleaching liquor is mixed in one of the vats with 5,000 lb. of pulp. This makes a mass of approximately 16 per cent consistency—a man can walk on it without sinking into it.

Every trace of color in the pulp must be bleached out white in order to get a good quality of finished paper. Grease or oil getting into the stock bleaches out colorless, but remains grease and leaves transparent spots on the finished paper. This trouble is especially troublesome as it cannot be detected until the paper is completely finished. White paper with transparent spots is rejected just the same as it would be with dark or dirty spots or streaks.

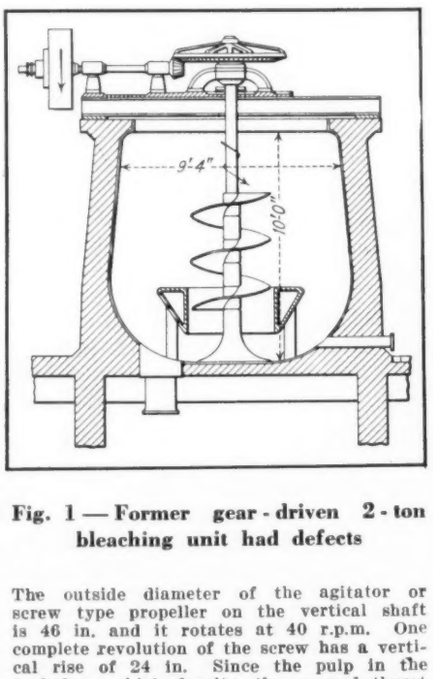


Fig. 1 — Former gear-driven 2-ton bleaching unit had defects

The outside diameter of the agitator or screw type propeller on the vertical shaft is 46 in. and it rotates at 40 r.p.m. One complete revolution of the screw has a vertical rise of 24 in. Since the pulp in the tank has a high density, the upward thrust of the vertical shaft is about 43,000 lb. It was difficult to take care properly of this upward thrust when using the open type of gearing and under heavy load conditions the gear and pinion were frequently forced entirely out of mesh. With this arrangement the gear noise was so great one had to shout to be heard. Serious breakdowns occurred, frequently involving expensive repairs and loss of time. The gears had to be greased daily and the surplus dropped on to the floor, part of it even getting into the bleaching tanks in spite of preventive measures.

Maintenance high on old units

The average maintenance cost of the four former units (Fig. 1) per year over a four-year period was $2,640.28. This cost figure includes gears and pinions, bearings, friction parts, oil and grease, belts and labor. We have found that the cost of maintaining these bleacher units was but a small portion of the total expense as this expense includes a 5 per cent loss in production of bleached pulp and a certain amount of poor quality of finished paper, which in most cases had to be sent back to the beater room and worked over again into cheaper grades of paper. Any time finished paper must be rejected as not up to standard and sent back to be shredded up into pulp again the unit cost per pound of paper is more than doubled, since it all has to go through the same process twice, and finally comes out in a cheaper grade of paper. This is very detrimental to the plant efficiency besides causing a certain amount of dissension between department heads.

Late in 1934 four Westinghouse speed reducers were placed in operation (Fig. 2). Revamping of the balance of the bleacher units was completed about nine months ago. The new inclosed gear units, using the original Westinghouse 75-hp., 690-r.p.m. motors and control equipment, require only about one-half as much floor space and also eliminate the countershafts with their numerous

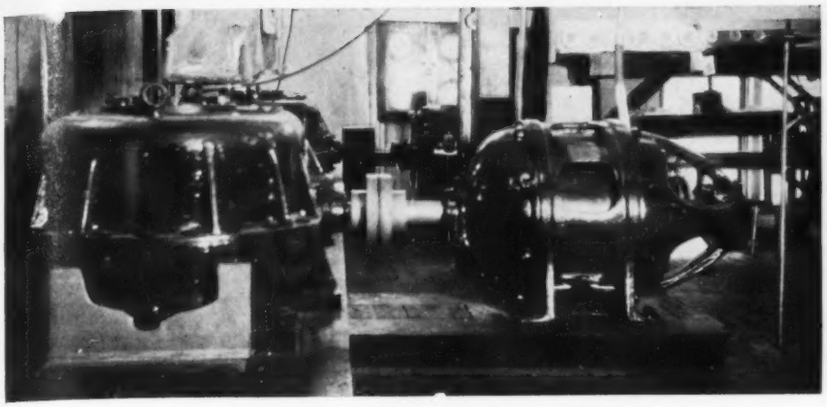


Fig. 2—Electrified gear units for the four bleaching vats are paying big dividends

The speed reducer is a double reduction gear unit driven by a direct-connected horizontal motor and delivering power to the bleacher unit through a low-speed vertical shaft; that is, the high- and low-speed shafts of the gear unit are at right angles. This double reduction unit uses spiral bevel gears in the first reduction and helical gears in the second or vertical reduction. A large Timken roller bearing in the gear unit takes care of the large upward thrust of the vertical agitator shaft. The gear unit complete with the two couplings weighs approximately 5,000 lb. The large low-speed coupling just underneath the gear case makes it possible to disconnect the vertical agitator shaft from the low-speed shaft of the gear unit without disturbing the setting of the unit when it is necessary to make repairs to the bottom bearing in the bleacher tank. With the original drives it was necessary to dismantle completely the thrust bearing and open gear drive before repairs could be made to this bottom bearing.

pulleys and belts. The former deafening, nerve-racking roar in this part of the plant has disappeared.

Benefits all around from new drives

Since the new equipment has been installed there has not been a minute of lost time for repairs and the transparent oil spots in the finished paper have been entirely eliminated. The once full-time supervisor responsible for the bleaching plant is now spending most of his time at other duties. This not only bettered his morale but also that of the men throughout the plant, especially those in the machine and finishing departments. There is absolutely no oil leakage around the present drives and the bleaching plant is now a show place of cleanliness. The 16 gallons of oil required in each new gear unit is replaced with new oil about every six months. The oil that is drawn off is not a total loss as it is filtered and used for general purpose lubrication.

A strong, rugged foundation was one of the important factors in the successful installation of this new equipment. This foundation was designed to be not only heavy enough to carry the weight of the reduction gear unit and motor but also to resist the tremendous upward thrust caused by the worm screw forcing the almost dry stock down through the midfeather and up around the sides of the vat. Little or no deflection or vibration is obtained by extra heavy I-beam supports installed on top of each vat to support the gear unit and motor.

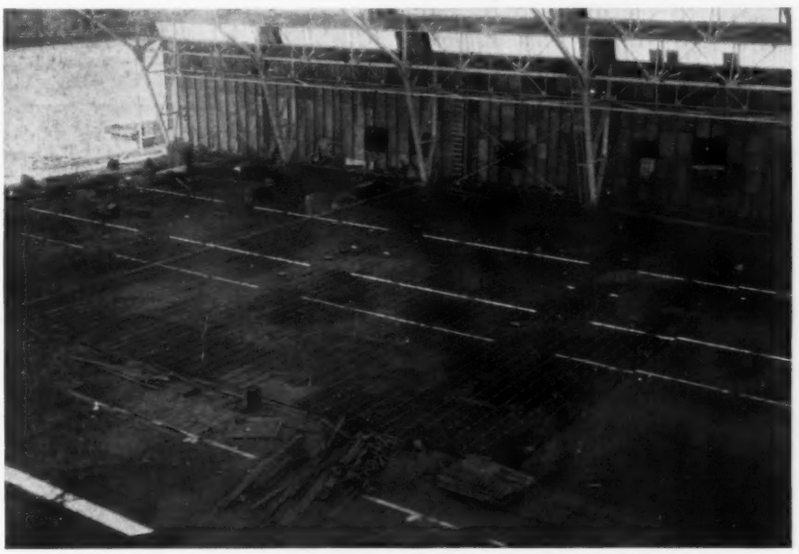
The modernization of our bleach plant has brought about many intangible savings that can only be estimated, as well as the actual dollars and cents savings. In proportion to the investment made the installation of these clean, quiet, inclosed motorized gear drives is paying bigger dividends than any other improvement made at Cherry River in years.

Heat the Floor to Warm Air Hangar

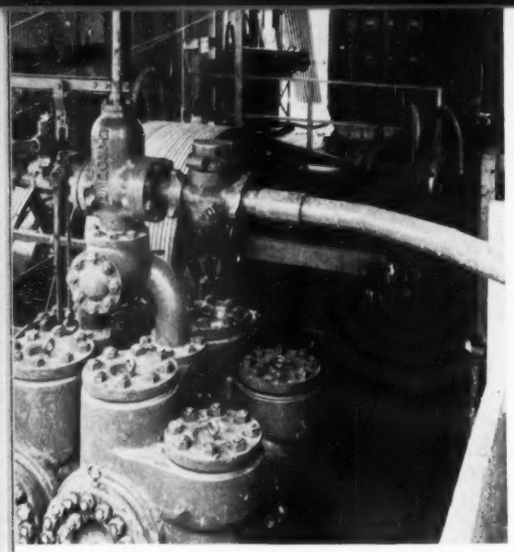
Revolutionary is the method of warming large-area buildings developed at the new hangar of the Douglas aircraft factory at Santa Monica, Calif. Efficient and economical heating arrangements for such large inclosures have long been a problem and the Douglas engineers decided that the best means of providing comfortable working conditions was actually to use the concrete floor slab as a source of heat.

To accomplish this novel electrical heating units, consisting of nichrome wire pulled in Fretz-Moon conduit and insulated therefrom by means of porcelain spacers, were developed. Units are of sufficient capacity to provide the most economical electrical distribution over the 300x300-ft. area of the hangar. As shown in the accompanying illustration, the units are laid in the form of loops on 3-ft. centers so that they will be in the center of a 2-in. slab of concrete when the floor is poured.

Calculated to raise the temperature of the concrete floor slab to 90 deg. F., the energy is supplied to the units at off-peak periods, thereby enabling a very favorable rate for power to be obtained. The concrete itself retains the heat for a long period, so that advantage can be taken of this method of supply. Complete data on performance of this installation will be published in an early issue of ELECTRICAL WORLD.



Douglas engineers go soil heating one better for hangar heating



A 300-hp. motor driving a 7¾x20-in. mud pump mounted as a unit on I-beam base

Motor and pump can be separated for transportation by removing four bolts on each side.

Oil Wells Drilled

Deeper Hunt for Oil Confirms Drift to Better Materials, Stronger Structures, More Powering of Reliable Flexibility

By C. C. STEWART

Power Sales Engineer Southern California Edison Company, Ventura, Calif.

WITH the ever-increasing depth to which the oil producer is drilling in search of oil, larger and better equipment is being built in order to make these deep drilling jobs possible. To the manufacturers of oil well equipment must go much of the credit for bringing oil out of the earth from depths of 1½ to more than 2 miles. Were it not for the development of better steel, alloy-steel and other alloy metals, which can withstand the high temperatures to which cutting edges are subjected at these great depths; were it not for better drill pipe and casing, better drawworks and cables, needed to carry the heavy load, and if it were not for better and stronger derricks and derrick equipment to support this weight the oil man would be helpless in his efforts to bring the oil from these lower sands. It seems to be the opinion of most of the oil men that the limit has not been reached and that in the near future wells will be drilled to depths below 15,000 ft., almost 3 miles.

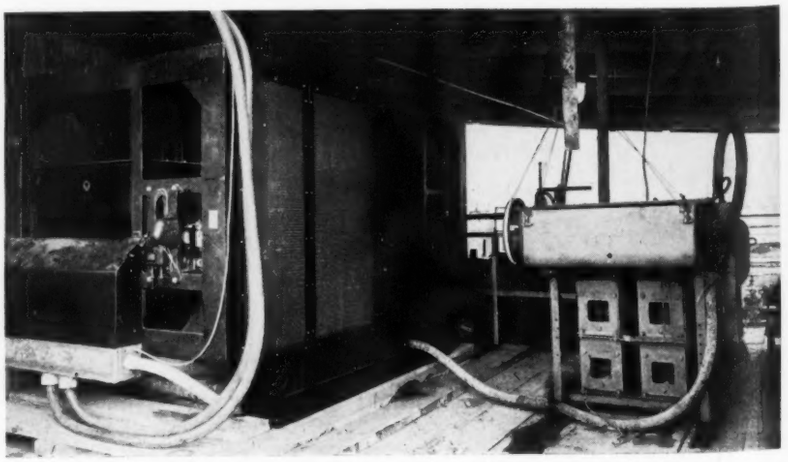
In addition to improvement in the above equipment it has been necessary to develop larger and more powerful drilling machinery, such as mud pumps, also drilling engines and electric motors for driving the mud pumps and draw-works.

An excellent example of a recent development of new and better equipment for drilling deep wells is one that is being used by the Chanslor Canfield Midway Oil Company in drilling its No. 1 well in Padre Juan Canyon, Ventura County, California. This is an all-electric drilling outfit and the equipment was designed to drill wells below 10,000 ft.

The mud pump that is being used to circulate the drilling fluid through the drill pipe to the drill bit at the bottom of the hole is a 7¾-in. bore, 20-in. stroke pump. It is driven by a 300-hp. motor, designed especially to handle this pump. This motor when combined with resistance and reactance control has a speed torque characteristic such that it will stall at approximately 2¼ times full-load torque. The control consists of alloy grids and a reactor in each leg of the secondary. Motor speed is regulated by cutting the resistance in or out in the usual way and the stalling point of the motor is varied by means of the reactor provided with taps, which makes it possible to increase or decrease the reactance in the motor circuit.

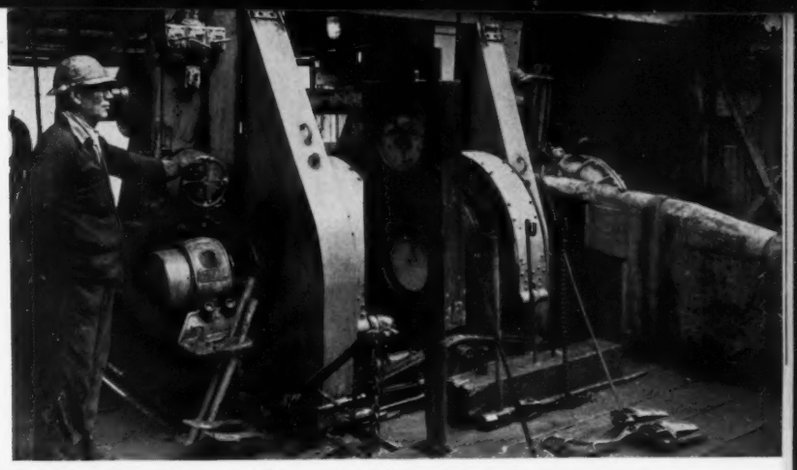
Reactors are set in order to stall the motor at a predetermined stalling pressure on the mud pump, this pressure varying with the diameter of the cylinder liners. The motor and control is constructed in this manner in order to keep the pump speed and the volume of mud as high as possible and yet be able to limit the maximum power that the motor is able to transmit to the pump. This characteristic makes it possible to maintain a constant pump pressure even with the motor stalled, for short periods of time. This can be accomplished without damage to the motor and control. With this type motor and controls it is possible to obtain operating characteristics similar to those of steam-driven pumps.

Drilling and hoisting at this rig are done by two 125-hp. protected type rotary drilling motors, chain driven through a speed-reducing unit to the draw-works. It is possible to operate either motor separately or both of them together; when operating together they will develop a maximum torque of 1,200 hp. The motors were especially designed for deep drilling, the diameter of the rotors having been



Control equipment for 300-hp. mud pump motor compactly housed

2 to 3 Miles Electrically



Meters perform a very important part in drilling straight holes

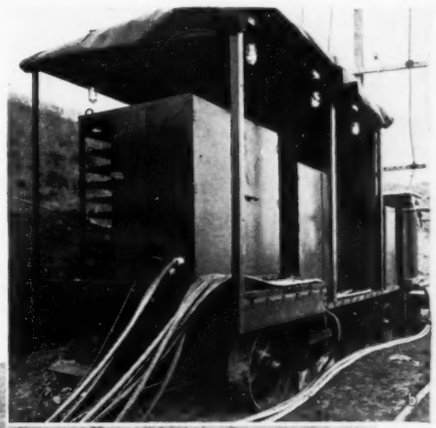
Behind the draw-works are drilling motors and reduction gear

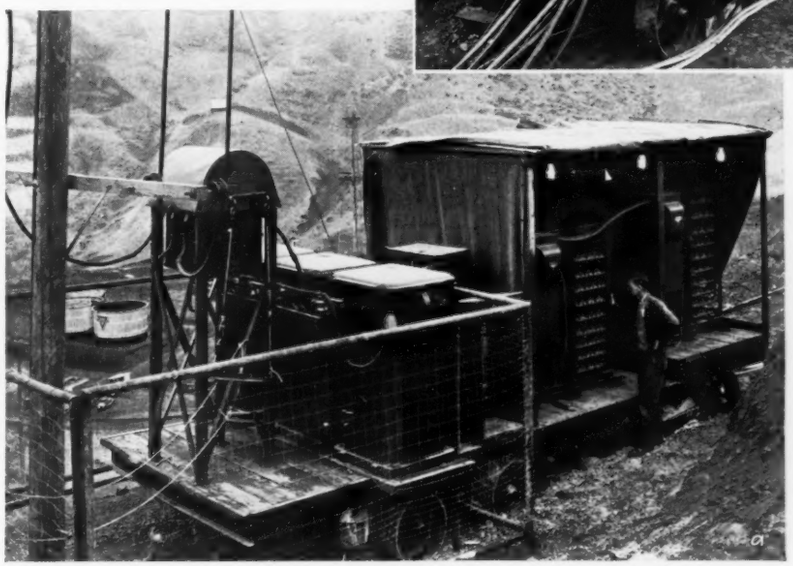
Complete motor equipment consists of two 125-hp. drilling motors, one 300-hp. mud pump motor, one 25/65-hp. mud pump motor driving a 6¾ x 14-in. mud pump for emergency service, one 25/65-hp. motor on the standard end and one 5-hp. motor on the mud screen, a total connected load of 685 hp. The highest monthly demand established in drilling the first well was 470 hp. The cost of electricity for drilling this well amounted to $18 per day, which is exceptionally low considering the fact that the well was cored practically the entire depth.

kept as small as possible in order to reduce to a minimum the energy that must be dissipated every time the motors are reversed. Open type magnetic control is used for regulating the speed of the motors and, as shown in an accompanying illustration, are mounted on a portable truck, which is located at a safe distance from the drilling well.

Special attention has been paid to make this drilling equipment as portable as possible, and when it is moved to a new location the minimum of labor will be required in removing the electrical wiring and equipment and reconnecting at the new location. The mud pump and motor are mounted on separate bases and can be separated by removing eight bolts.

The oil company owns the transformers and takes the power from the utility company's 16,000-volt lines and transforms it to 480 volts for the motors. These transformers, together with the magnetic control, are mounted on the portable truck, which can be easily transported from one location to another by means of a tractor. Flexible rubber cables connect the motors on the derrick floor with the control truck. The cables are laid in a metal trough supported on legs, and can be removed easily and coiled up for moving.





Transformers and control apparatus mounted on a portable truck

(a) This drilling equipment is located on the mountain side. In the canyon below can be seen another well and oil tanks. (b) Close-up view of portable truck showing cables to the motors, also cabinet housing contactors, with rheostats in back.

Industry Electrifies to Modernize

New electrical installations mark moves toward meeting the production pace of a revival era. Typical instances show an enlivening of all types of processing and fabrication

Quality Output Gain by Electric Heating

In modernizing the famous silverware factory of Reed & Barton at Taunton, Mass., electric heating both increases and improves production in the cutlery department in comparison with former methods. In soldering knives, both sterling and plate, the following steps occur: (1) the two halves of the handle are spot-welded; (2) a charge of granulated silver solder and flux is applied to the open end of the hollow handle, which is then placed on a woven metal belt and run through a 12-amp., 375-volt Process Engineering & Equipment Corporation electric furnace; (3) the blade and handle are assembled at an Ames electric welder with a charge of soft solder and a flux; (4) the blade end or tang is inserted in the welder jaws, and the resistance of the handle melts the solder and joins the blade and handle for final union.

The electric furnace belt is run by a ¼-hp. induction motor through a Reeves variable-speed drive at 1 ft. per minute. Seven minutes of heat at 1,520 to 1,640 deg. F. are applied in welding the handle parts, after which thirteen minutes of cooling follows. The stock is surrounded by an atmosphere of hydrogen and nitrogen to prevent oxidation. When the solder melts it is carried around the seam between the abutting edges by capillary attraction and the halves are welded firmly together. To prevent marring the outside surface of the handle it is given an application of whiting before entering the furnace. This is later removed, with any adhering solder. Formerly an operator using hand methods could solder 120 dozen handles a week (5½ days), and the atmospheric conditions were poorly controlled in comparison with the electric furnace. Today the modern method illustrated enables from 16 to 25 dozen handles per hour to be soldered by one man, and uniform quality is assured through suitable temperature, atmospheric and speed control by automatic means.

In the old method of uniting the handles and blades pitch was used, and this sometimes led to melting and separation of blade and handle in boiling water. Electric welding eliminates this possibility. The Ames welder will accommodate three knives at a time and is rated at 3 to 10 amp. at 550 volts. A General Electric relay controls the time current is applied to the work, ordinarily from 10 to 32 seconds. A girl operator can weld nine dozen knives an hour compared with two dozen under the former conditions. To fit different knife patterns, 150 welding electrodes are stocked by the manufacturer.

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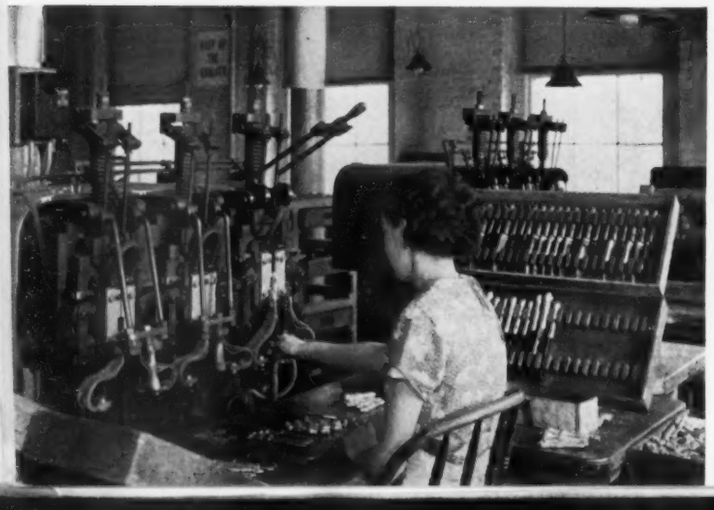
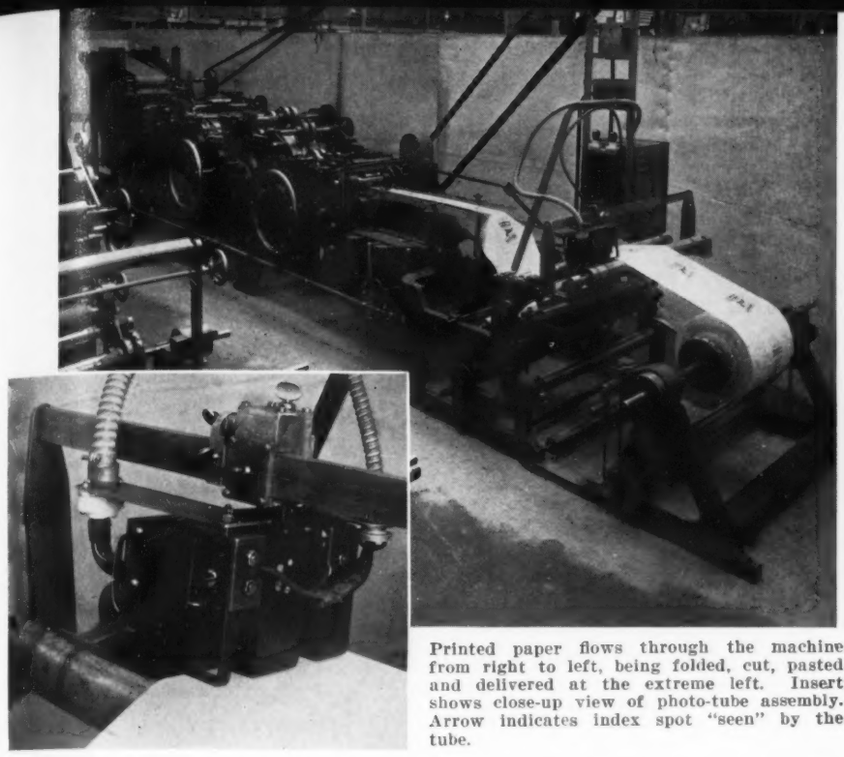
Photo-Tube Control Indexes Bag Designs

In the manufacture of printed paper bags for packaging coffee, cement, lime, etc., the cutting process and the speed of travel of material flowing through bag-forming machines must be very accurately controlled if the design on the finished bag is to be exactly located. Paper on which the bag design has already been printed is fed into the bag-forming machine at rates as high as 500 ft. per minute. At this speed variations of 1/100 of an inch in the point at which the knife operates in cutting the bag to proper length will produce an accumulating error which in 24 seconds will result in the design being one inch out of position one way or the other, depending on whether the rate of feed is too fast or too slow. A tremendous amount of

Cutlery fabricated with electric aids





Printed paper flows through the machine from right to left, being folded, cut, pasted and delivered at the extreme left. Insert shows close-up view of photo-tube assembly. Arrow indicates index spot "seen" by the tube.

Photo-electric control on paper-bag-forming machine insures proper location of printed designs on finished bag

waste results, particularly if the design is intricate and covers most of the bag.

To prevent this waste a photo-electrically controlled double differential compensator developed by the Potdevin Machine Company, Brooklyn, is being used by the larger package manufacturers. This compensator, which consists of two differentials and a variable-speed drive, not only makes it possible to correct any permanent error in the distance between prints but, with the aid of the photo-electric control, compensates for any temporary errors which may arise due to stretch or shrinkage of paper, etc. The result is a steady flow of perfectly indexed printed bags from the forming machine.

A spot printed on the bag material at the same time as the rest of the design is under the constantly vigilant eye of a photo-electric tube. If the knife is in its proper position when the printed mark on the moving paper interrupts the reflected light beam two brushes on a selector switch synchronized with the cutter will be on a non-conducting portion of the switch and no adjusting action occurs. If, however, the knife is either ahead or behind the proper position with respect to the mark on the paper interruption of the light beam will occur when the brushes are in contact with the conducting segment and current will flow through the control circuit. This will operate one of the grid glow tubes in the control circuit and energize the proper solenoid either to advance or retard the position of the paper with respect to the cutter through the differential arrangement and the variable-speed drive mechanism.

To obtain operation at high paper speeds the grid glow tubes are operated on direct current obtained from a rectifier. Thus locking or holding characteristics are obtained. In order to permit easy adjustment of the length of time that solenoids are energized and the correction in paper speed is to be made an electronic time-delay relay is included that operates after its adjustable time has elapsed, to interrupt momentarily the direct-current supply to the grid glow tubes, thus resetting the equipment for the next operation.

Application of this compensator is not limited to paper bags, but may be applied wherever a printed design must be located in an exact spot on a printed sheet of any kind.

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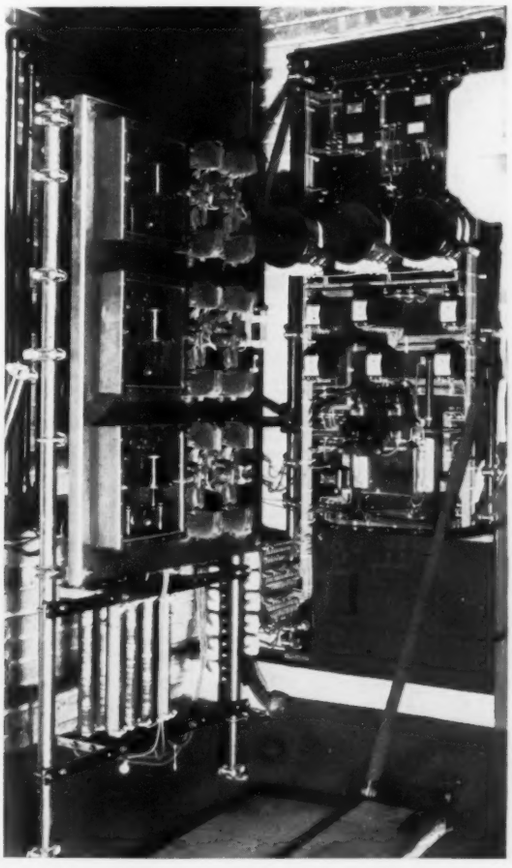
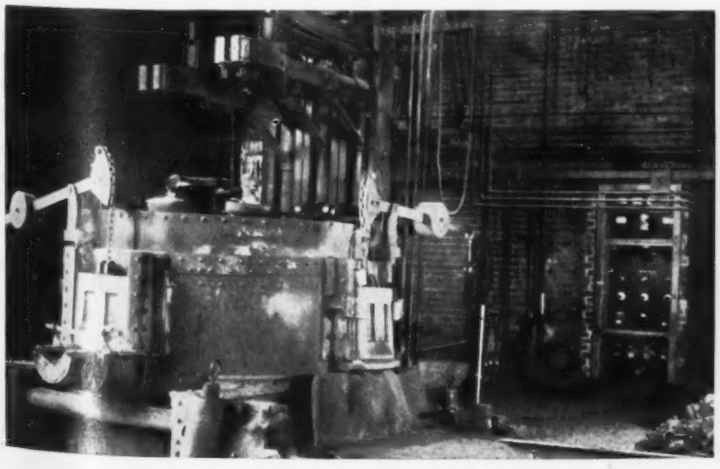
Better Regulation Boosts Lining Life

Substantial increase in furnace lining life and considerably reduced maintenance followed installation of a modern 2,250-kva. transformer equipped with an automatic, remote-control tap-changer on a 3-ton electric



Automatic remote control tap-changer on transformer serving 3-ton electric furnace increases lining life. Regulator panel and rear of operator's panel is at right



furnace in a Pennsylvania tool steel mill. Old equipment used with this furnace formerly provided but one voltage, which had to be used for both refining and melting.

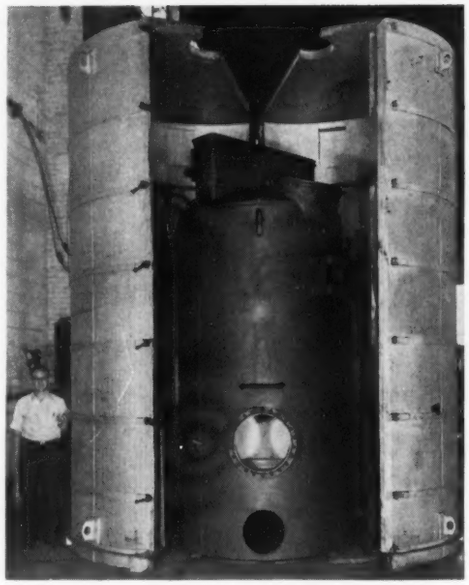
The new transformer, with its modern control, provides four different voltages. Thus a high heat may be used for melting and the transformer taps changed to provide lower voltages for refining. Experience gained over eighteen months with the new Westinghouse equipment shows that the better regulation of heat makes furnace linings last 15 per cent longer than with the old equipment.

•

Electric "Silo" Bakes on Paint

To meet exacting specifications on a recent government order for oil circuit breakers covering painting of tanks the Condit Electrical Manufacturing Corporation (Allis-Chalmers subsidiary), Boston, Mass., decided to try electric baking for these large units in its Hyde Park factory. P. S. Thorsen, South Boston, was retained to build a sectional oven along lines previously successful in other applications, and the result has been an improvement in method which promises to yield increased durability of painted surfaces exposed to wind and dust.

The oven, or "silo" as it is informally called at the Condit plant, consists of a sectional heat-insulated cylinder about 17 ft. high, 10 ft. 4 in. in diameter outside and with a wall 14 in. thick. The insulation is disposed between metal surfaces held in place by a steel frame and the assembly is hinged and portable by being mounted on rollers for convenient handling by the shop crane. The oven is open at the bottom on the inside and is designed with annular air spaces and adjustable dampers, permitting easy control of inside circulation. Heating elements are mounted in an annular space 3 ft. 6 in. high x 6 in. wide at the lower portion of the cylinder and have a combined rating of 75 kw. to maintain an inside temperature of 400 deg. F. with thermostatic control. Heating units are rated at 220 volts and are connected in series-parallel for operation on a 440-volt shop supply, Boston Edison service being delivered to the plant for general uses. A maximum input of 100 kw. can be had at the oven. A ¼-hp., motor-driven blower attached to the oven provides for recirculation of air every two minutes, provision also being made for "make-up" air when needed. Oven heating units are connected to three three-phase circuits to secure suitable balance and regulation of voltage.



High-voltage oil circuit breaker tank placed in electric "silo" for baking paint on surface to resist abrasion from wind and dust

The oven is designed to handle tanks for 135-kv. breakers and downward and is also used in baking paint on various truss members of various fabricated sections of breaker mounting frames, especially of the 46-kv. and 69-kv. ratings, supporting these from a 1-ton jib crane. Temperatures used ordinarily vary between 225 and 460 deg. F., according to the baking requirements. Baking time varies from three to five hours per coat and each coat is baked. The processing includes sand blasting to virgin metal, then immediately a positive coat or sub-primer is applied and baked on, then a primer coat and, finally, the finish coat. This improvement in the baking process has made possible the use of baking paints on such applications as these large circuit breakers for conditions of service requiring resistance to abrasion (as in duststorm areas) and also utilizing paints having sufficient elasticity to remain bonded to the metal. This gives most of the advantages of enamel and avoids the disadvantage enamel presents on account of its relative thinness.

•

Modern Arrangement for Furnace Control

A modern arrangement of control equipment is being used with an installation of 16 induction-type copper and brass melting furnaces, each rated at 75 to 90 kva. at 500 volts, 60 cycles, single phase, at Revere Copper & Brass, Inc., Rome, N. Y.

Located in a tunnel which runs the length of the casting shop below the furnace floor level, the control equipment for each furnace consists of a 120-kva. capacitor equipment for power-factor correction, a 32.5-kva. Pyranol-filled transformer for the low-voltage holding circuit, automatic circuit breaker equipment for main

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Ford Anneals Steel Strip With Electric Heat

[*Continued from page 61*]

is set on the hood and water flowed down the outside after the furnace has been removed to another stand.

As appears in the plan diagram, each set of three stands is accompanied by one instrument panel, one control contactor cabinet and two receptacle racks. The bell furnace associated with this group may work on any of these stands, its flexible lead connections being plugged into either receptacle rack. But a furnace may not be worked on any other than its own three stands. This is because the thermocouples in the furnace are calibrated with the recording instruments and control devices in the one location and would not function correctly in another setup.

With the great variety of drawing characteristics required in the annealed steel and with the obvious desirability of keeping each furnace in continuous operation it is apparent that the work of the installation must be rigorously scheduled. It would not do, for instance, for a load of steel requiring only a short anneal to be run into the operating routine of a unit group that was getting out strip for deep draws. To do so would impose an idle period on the furnace. Of course, there are times when such changes in unit production have to be made, but in the interest of operating economy the anneal boss earnestly endeavors to make them as infrequently as he possibly can.

circuit, inclosed type safety switches for auxiliary circuits.

The main overload circuit breaker, of the air-break type, controls the furnace input. The controller panel controls both the full melting capacity of the furnace and the circuit maintained during the holding or standby period. Circuits are interlocked to prevent incorrect operation. Safety-inclosed switches are employed for the control of the auxiliary circuits.

The low voltage that is required by the furnaces during the standby period is furnished from 32½-kva. transformer units for 500-volt primary and 210-volt secondary operation with six taps below to obtain other voltages as may be required. These taps are arranged for adjustment by a tap changer mounted on the outside of the transformer tank and with interlocks to prevent tap changing unless the main breaker has been opened previously, thus protecting against changing taps under load conditions. The transformers, being Pyranol filled, avoid the hazard of fire or explosion. To compensate for the inherent low power factor of the equipment the capacitors are provided, raising the power factor to a predetermined value under current conditions.

Busbars supplying the various circuits are arranged overhead on heavy-duty post-type supports, and the assembly is guarded by a heavy screening. Every precaution has been taken to protect the operator and maintenance crew and the entire arrangement is such that a very flexible system of control is available.

The furnace operator controls the melting and holding circuits from the floor above by means of push-button stations. The metering equipment is also located there.

Control units for electric melting furnaces installed in tunnel under furnace floor. Note busbars arranged overhead, guarded by screening

Light Enables Production Bogey to Be Met and Exceeded

Westinghouse photo

The 400-watt mercury-vapor Glassteel units in this reflector-plant polishing room raised the former intensity from 16 to 35 ft.-candles. Then the men could only turn out 85 per cent of their assigned production; now they are turning out 120 per cent

Electric Furnace Excels for Melting

BY T. L. ROBINSON
Technical Vice-President
McGill Manufacturing Company,
Valparaiso, Ind.

If it were possible to collect national average figures on melting costs per pound very probably oil and gas would show up at lower cost levels than would electricity in the field of non-ferrous metal melting. But there are many other things than just melting cost that have to be taken into account in successful foundry operation. And it is these other things as they appear in seven years experience with electric melting that convinced the McGill Manufacturing Company of the superior performance of electric furnaces.

The accompanying record of operation for a typical month of 24 working days shows an average of 8.8 melts per day. This figure indicates an outstanding advantage of the electric furnace, speed of melting. We tried gas firing a few years ago and

Electric Furnace Performance—A Typical Month Melting Aluminum Bronze

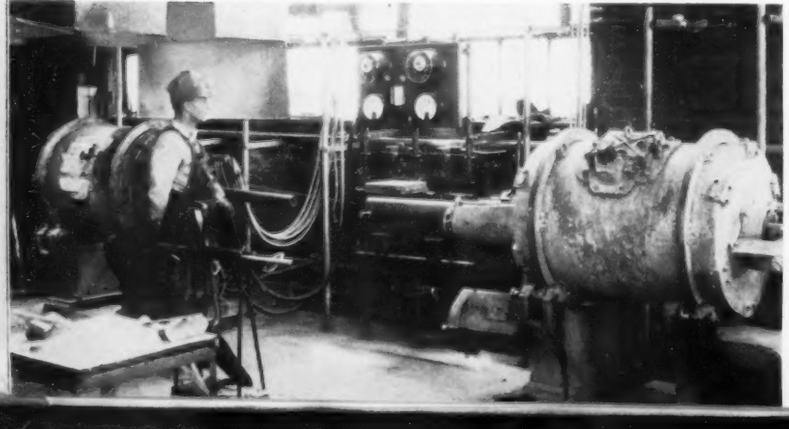
(June 29 — July 30, 1936)

Day	No. of Heats	Copper	Scrap Alum. Bronze	Alloy Lb.	Alloy Oz.	Killowatt-Hours Melt	Killowatt-Hours Reheat	Killowatt-Hours Charged	Pounds Melted	Kw.-Hr. per Lb.
29	9	....	1,240	6	4	345	109	454	1,066	0.426
30	10	564	830	97	2	335	96	431	1,209	0.357
1	10	658	625	111	12	334	77	411	1,330	0.309
2	9	188	724	64	8	283	85	368	908	0.395
3	....	....	....	....	..	....	....	....	....	....
4	....	....	....	....	..	....	....	....	....	....
5	....	....	....	....	..	....	....	....	....	....
6	9	144	540	23	2	294	80	374	535	0.698
7	8	517	230	86	7	237	86	323	724	0.446
8	5	329	150	66	2	166	55	221	448	0.495
9	9	517	350	89	2	289	66	355	898	0.395
10	7	566	100	89	2	200	50	250	623	0.402
11	....	....	....	....	..	....	....	....	....	....
12	....	....	....	....	..	....	....	....	....	....
13	8	660	150	108	..	272	96	368	735	0.365
14	9	658	520	114	12	308	61	369	850	0.503
15	9	658	510	132	..	300	82	382	1,565	0.242
16	10	846	410	154	..	327	52	379	1,325	0.286
17	5	376	435	52	..	200	61	261	696	0.375
18	....	....	....	....	..	....	....	....	....	....
19	....	....	....	....	..	....	....	....	....	....
20	12	940	605	171	..	409	61	470	1,534	0.306
21	10	658	760	120	8	354	85	439	1,394	0.315
22	7	376	790	69	8	285	75	360	957	0.376
23	10	752	675	137	..	352	73	425	1,415	0.300
24	10	564	890	104	..	370	84	454	1,306	0.347
25	....	....	....	....	..	....	....	....	....	....
26	....	....	....	....	..	....	....	....	....	....
27	9	564	650	112	..	298	114	412	902	0.458
28	8	470	840	84	8	308	74	382	1,302	0.293
29	9	564	770	101	14	298	104	402	1,247	0.323
30	10	470	850	91	8	334	70	404	1,176	0.342
31	9	423	750	77	8	280	107	387	1,135	0.341
Total	211	12,462	14,394	2,263	11	7,178	1,903	9,081	25,298	
Averages	8.8	519	600	94.3		295	79.2	378	1,054	0.359

melting time was almost tripled. Also, better control of alloy is very important, particularly for die casting, which is the work of this furnace. And working conditions in the foundry are much better than they would be if fuel furnaces were used. Reduction of metal lost by burning is something to be considered, too. The typical record shows 29,120 lb. of metal charged in 24 days and 25,298 lb. of castings produced, a loss of only 13.2 per cent. This is the overall loss, which includes pouring. The actual melting loss is much less, somewhere between the values of 3 and 6 per cent.

The McGill Manufacturing Company has two Detroit Electric rocker type furnaces. One is used for melting manganese brass and the other, to which the record data apply, for production of aluminum bronze die castings. A considerable proportion of the castings poured from this furnace is of parts for disconnecting switches, bus hardware and other products of electric specialty manufacturers.

As the record shows, the furnaces operate on a five-day-week schedule, eight hours per day. At the end of the day the furnace is charged with the regular quantity of copper and scrap. By morning this metal is pretty well melted by the stored heat and the alloy proportions are added for the first melt. Week-ends are utilized for patching the linings—changing them when required—and for general maintenance. By close attention to their condition the linings of these furnaces are given lives of from 1,600 to 2,000 hours, as against 1,000 hours, which is a frequent period in other installations.



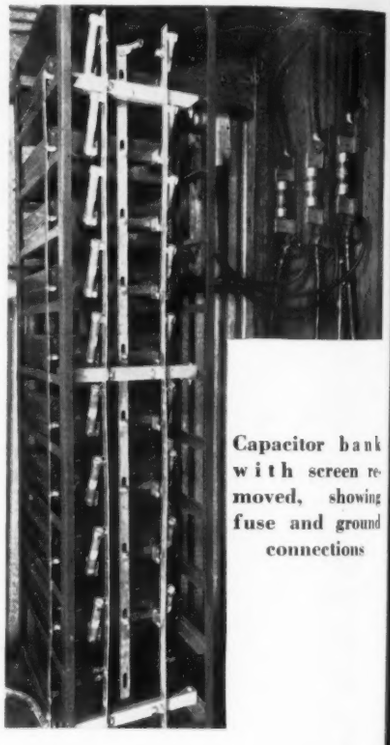
For fast production of brass and bronze castings

Furnace at left, under fume hood, melts manganese brass. One at right aluminum bronze. Controls and meters for both are conveniently located on panel betweeen them.

Power Factor Raised at Low Cost

By P. N. RUGG
Boston Edison Company

Over in Chelsea, Mass., a manufacturing chemical house by the name of Samuel Cabot, Inc., operates a plant including around 125 motors, chiefly squirrel-cage inductions, with a total connected load of about 678 hp., dominant sizes ranging from 5 to 30 hp. maximum. The power factor used to run between 64 and 68 per cent and the billing demand was about 116 kw. A survey of costs showed that if 45 kva. in capacitors were installed in a group assembly across the 230-volt, three-phase power supply on the load side of the meters the power factor could be raised to 80 per cent or better, and the job would pay for itself in about two years through reduced demand charges alone.

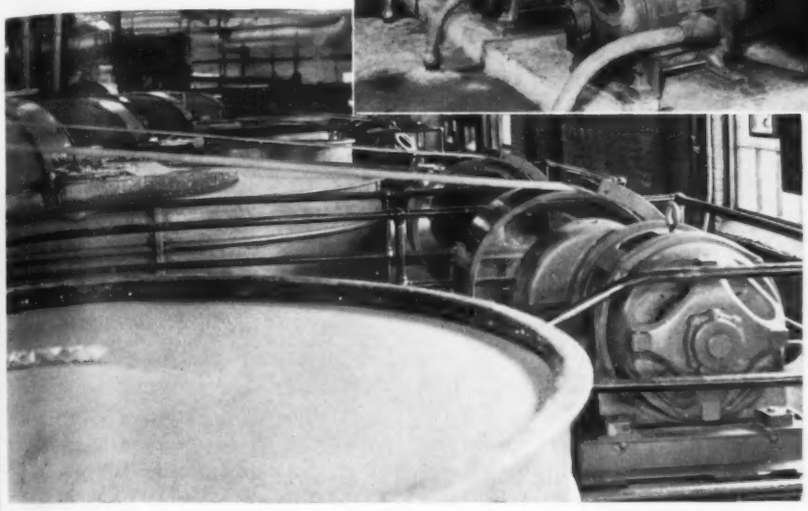


Capacitor bank with screen removed, showing fuse and ground connections

A rack of nine General Electric capacitors rated at 5 kva. each and mounted compactly one above the other in a corner of the meter house was installed at a cost of about $21 per kva., or $945. Each unit has its own inclosed fusing with provision for rapid replacement and direct tap to the phase bus, a ground connection being made at one side and terminating at the floor as shown. In

Two gearmotors on beaters afford $40 monthly saving

A battery of jordans powered by gearmotors



a typical month the demand was cut from 116 to 94 kw., making a saving of 22 kw. billed at $2 each. The electric service totaled 22,600 kw.-hr. and the power factor was slightly over 80 per cent.

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Fiber Board Mill Goes to Gearmotors

Drives for beaters and jordans at the fiber board mill of the American Boxboard Company at Grand Rapids, Mich., are being modernized. Already four 100-hp. Westinghouse gearmotors are operating jordans and five 60-hp. Westinghouse gearmotors are belted to individual beaters.

Formerly the beaters were driven in pairs by 150-hp. squirrel-cage induction motors. Being of the slow-speed type, their power factor and efficiency were both low, especially when the beaters were operated under load. These 150-hp. motors are being replaced with two 60-hp. high-efficiency gearmotors equipped with built-in thermoguard overload protection. Any beater can be operated full load without danger of harming the motor.

It is estimated by the chief engineer that each pair of 60-hp. gearmotors will effect a saving of 21 hp. over the one 150-hp. motor formerly used, which, on the basis of approximately 9,000 kw.-hr. saved per pair of beaters, is nearly $40 monthly.

The use of gearmotors in this plant has an additional advantage in that with their high power-factor operation it is unnecessary to use corrective apparatus.

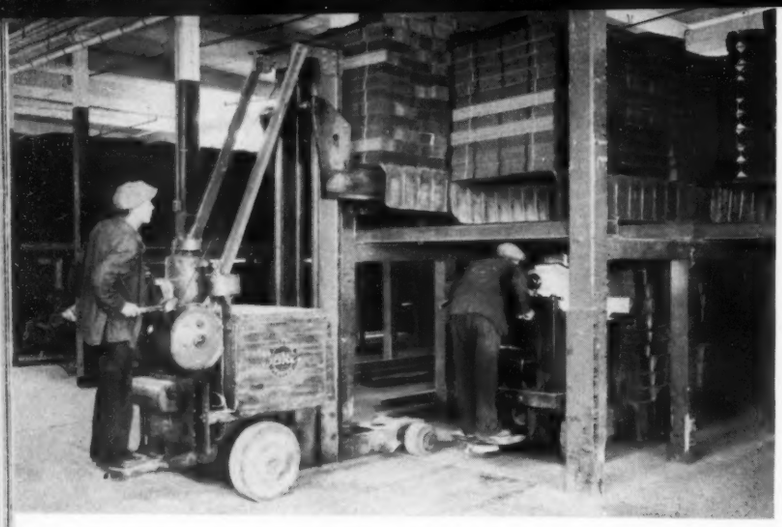
All the gearmotors receive their power from a new 3,750-kva. generator driven by a bleeder turbine and the savings in the amount of coal alone required for this new turbine over three old reciprocating steam engines and three old steam turbines will amount to approximately $45,000 a year, which will pay off the entire investment in four years.

Combination Units Better Than Daylight

Large drafting rooms require the most exacting of lighting applications. At the Douglas aircraft plant at Santa Monica, Calif., the problem of providing adequate illumination in a saw-toothed loft 300 ft. long and 125 ft. wide was solved by a combination of 300-watt Mazda lamps and 1,000-watt mercury-vapor units. Because of the exacting nature of the work, it was estimated that intensities of between 50 and 70 ft.-candles had to be provided.

This amount of illumination was secured by installing two rows of 300-watt Mazda units in glass steel reflectors and one row of 1,000-watt mercury-vapor units in each of the five bays which comprise the room. Mazda lighting units are mounted 11 ft. above the floor and mercury-vapor units 15 ft. above the floor. Lamp spacing is 12½x8 ft. The total installation consists of 48 kw. of mercury-vapor units and 72 kw. of Mazda units. Draftsmen report that the artificial illumination provided is superior to normal daylight conditions.

3-to-2 ratio gives spectral optimum for drafting



Low and high-lift trucks answer product storage

Electric Trucks and Storage Problem

Bird & Son, Inc., solved a difficult handling problem in its roofing materials plant at East Walpole, Mass., by utilizing Baker-Raulang 3-ton industrial electric trucks of the lift type for storing this product in assorted colors in double-deck tiers of portable skids. A loaded skid of roofing material weighs about 2.5 tons, consisting essentially of felt saturated with asphalt and surfaced with crushed slate. The skid loads could not be tiered one upon the other without danger of spoiling many of the asphalt shingles of the underneath layers through cutting or scoring by the edges of the upper metal skid, so provision was made for double-decking the skids on removable I-beams.

Active stock on the floor level is handled by low-lift trucks and the "second-story work" is done by "Hy-Lift" units, all equipped with Edison batteries. In this way stock can be piled to a height of about 10 ft. and identification of colored stock even 50 ft. from the aisles in the recesses of the storage space speeded up by battery-operated floodlights on the trucks. The company has computed that it costs only 24 cents per ton to load outgoing cars by storage battery truck as compared with 49 cents with manual labor prior to the installation of the skid-lift system.

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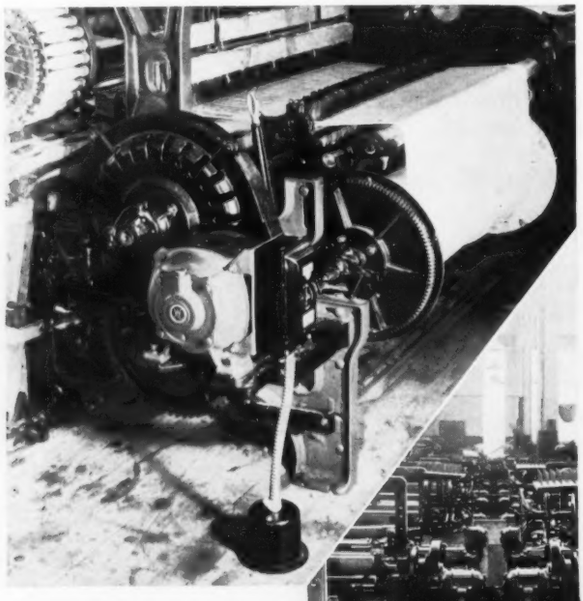
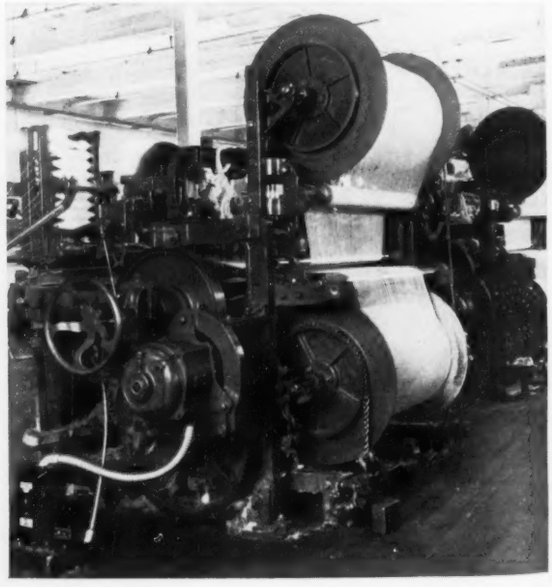
Electric Hardening Increases Production

John Bath & Company, Inc., Worcester, Mass., appropriated around $2,880 for two Hayes electric hardening furnaces in order to secure improved quality and regularity of production in manufacturing an extended line of ground-thread tools composed of "18-4-1" high-speed steel. Four gas furnaces were superseded. The saving in labor effected, $1,500 per year, enables the company to do the volume of hardening with two men which formerly required three. The electric furnace installation provides a rapid "build-up" of heat before the shop opens in the morning, compared with about two hours in the gas days,

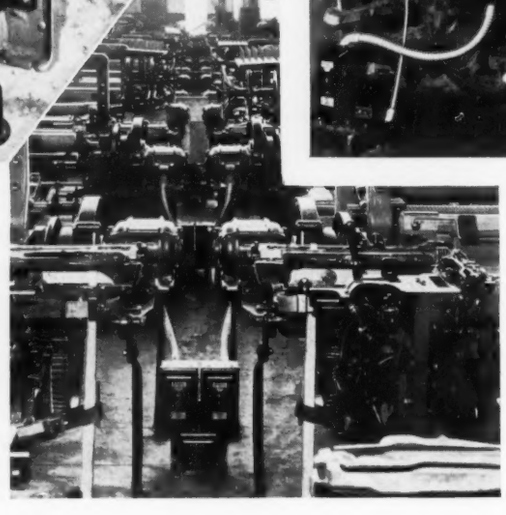
Control and Drive Simplicity in the Textile Plant



Above—Motor-mounted switch modernizes draper loom. Switch convenient. Cleaning and floor sweeping facilitated. Motor 1-hp., 550-volt, loom-model. Waste-packed bearings maintain lubrication under extreme vibration



Above — Towel loom motor has three-point mounting. Crompton & Knowles loom. Westinghouse 1-hp. motor. Mounting rigid, allowing for easy assembly and convenient adjustment for gear alignment



At left — Pedestal-mounted controls on weave room floor. Motors are ½ hp. 550 volt in this case

Photos Courtesy Westinghouse

Uniform production assured by electric preheating and hardening furnaces

and it also sets the stage for a mass-production routine in hardening tools of specified size and style. The management states that the main reason for the increased production is the efficiency and certainty with which the hardener is able to proceed. A formula has been worked out for hardening each type of tool and the operator simply follows this without worry or guesswork.

This house tests tools thoroughly and concentrates upon obtaining uniformity of product. Microscopic tests are included and a much more uniform grain structure is reported than with the former heat method. Previously it had to be content with a range that included a coarse grain at one extreme and no grain boundary whatever at the other extreme. With the electric furnace the company is able to control the material with a small grain with slight boundary and good carbide solution. Hardness is maintained within a half point of 64 R_c, compared with a previous range of 62½-64. Results can be predetermined with highly satisfactory accuracy. One furnace, used for preheating around 1,600 deg. F., is rated at 16 kw., and the other, used for hardening (2,350-2,400 deg. F.), is rated at 32 kw. Energy is supplied by the Worcester Electric Light Company to the building and thermostatic control maintains the temperature within a few degrees when the charge is heated. The operator is warned by an automatic clock alarm when the preset time of treatment has been reached. Oxidation is prevented by a gas curtain at the front of the oven.

Flexible Wiring Serves Lighting Job

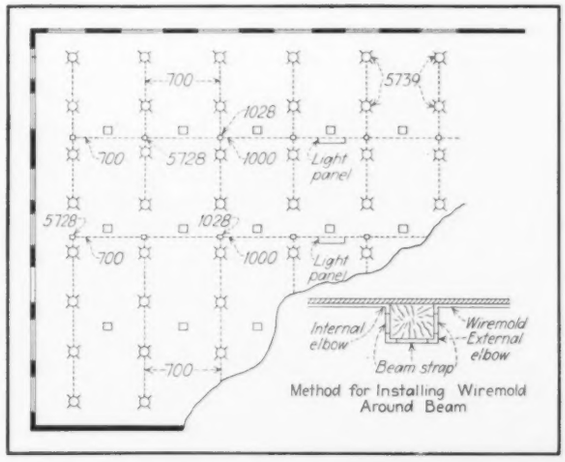
A recently designed factory was laid out so that economical production on the basis of carefully controlled investment outlay and the utilization of modern methods of wiring could be achieved.

The factory was 235 ft. long by 90 ft. wide, with beams 8 ft. apart. The lighting problem was solved by eight rows of outlets equipped with "RLM" domes mounted 11 ft. 6 in. apart and 12 ft. 6 in. above the floor. In general, No. 700 "Wiremold" was employed for branch circuit wiring and all main runs where the number of conductors carried did not exceed four.

On main runs with more than four conductors No. 1,000 "wiremold" was used. Installation of this material, run at right angles to the floor and roof beams, was facilitated by the use of beam strap by the same maker, which materially lowered the job cost. The average illumination in this factory is approximately 13 ft.-candles.

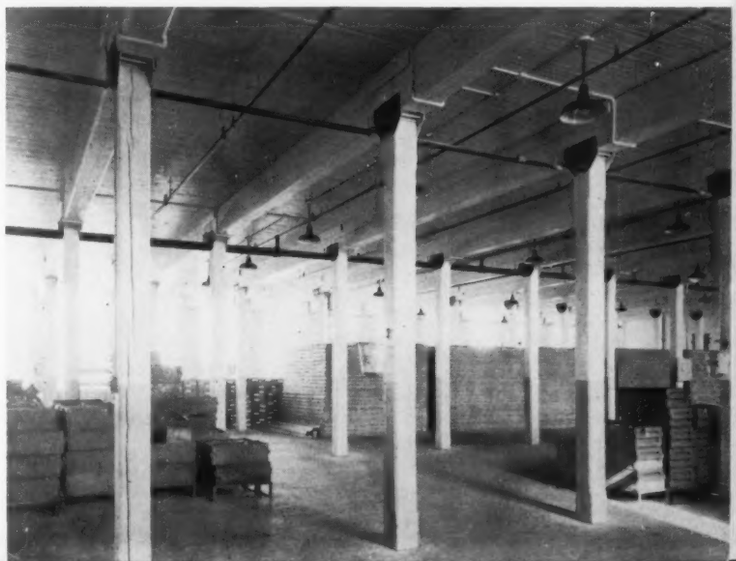
Advantages of the material for the particular job were ease of installation due to the slip joint provided, the small number of fittings required for the job, ease of relocating outlets and placing additional ones, inconspicuous nature of the installation and the lack of obstruction of the headroom.

The flexibility is illustrated further by the use of the manufacturer's No. 1028 utility fitting as a cross, tee, junction box and distributing box service accessory.

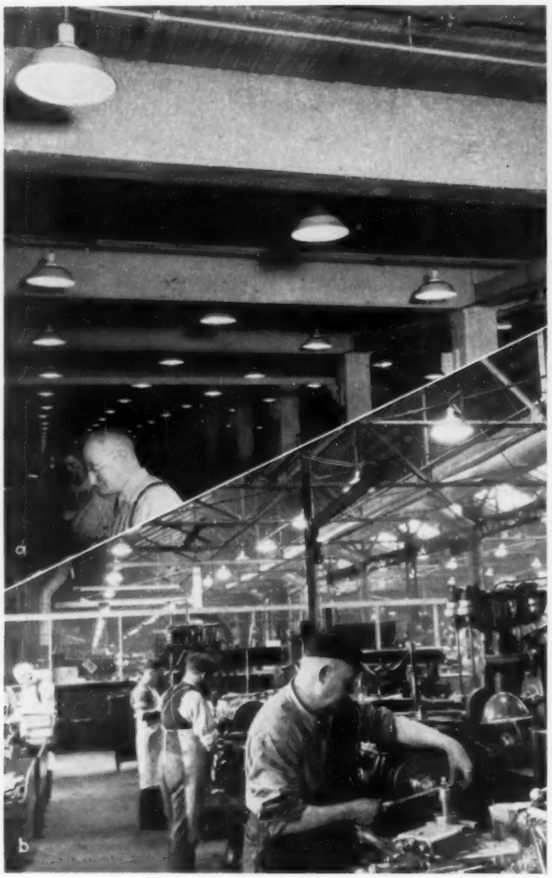


Main and branch circuits for factory lighting, using "Wiremold" fittings

Main and branch lighting circuits were run close to the ceiling and beam surfaces to conserve headroom



Electrical Manufactures Exemplify Adequate Light for Production



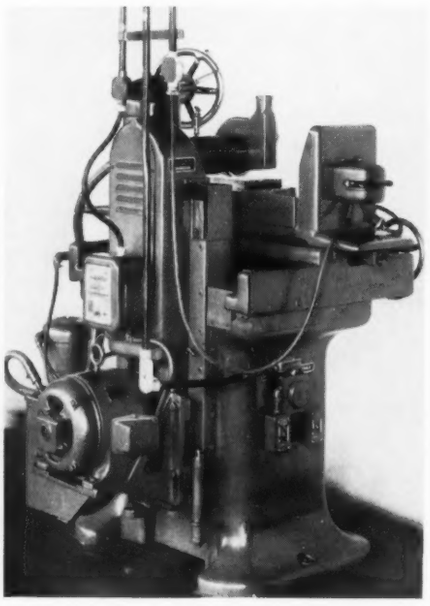
INTENSITIES RANGE FROM 18 to 22 FT.-CANDLES — Switching is done by A B breakers and provisions are made in the conduit fittings and wiring for the addition of future fixtures to increase lighting to meet unusual conditions in these Westinghouse departments:

	Department	Floor Area	Reflector	Spacing	Mounting Height	Foot-Candles
(a)	.....	400 x 70	500-w. Glassteel	11 x 11*	12	18
(b)	Machining.....	208 x 80	Glassteel	10 x 10	12	20
(c)	Machining.....	1,200 x 80	Glassteel	16 x 16	16	22
(d)	Wire Enameling.....	.....	500-w. Glassteel	10 x 8†	10–14	18

*Staggered, flush with bottoms of beams. †Mounted to suit location of towers.

Tool Drive, Control Compact and Handy

The extent to which modern machine tools are now being electrified is illustrated by the accompanying view of a Norton surface grinder lately installed at the Reed-Prentice Corporation's factory in Worcester, Mass. In place of the mechanical drive of grinders formerly provided from line shafting this unit is equipped with three motors and a magnetic chuck. The main drive motor, 1½ hp. Century make, 1,800 r.p.m., is mounted on an adjustable bracket at the left lower center; inside the grinder is another Century motor, ½ hp., 1,800 r.p.m., driving a pressure oil pump which supplies the transmission medium for the machine, and at the extreme left is a special vertical Ruthman motor driving a lubricating pump.



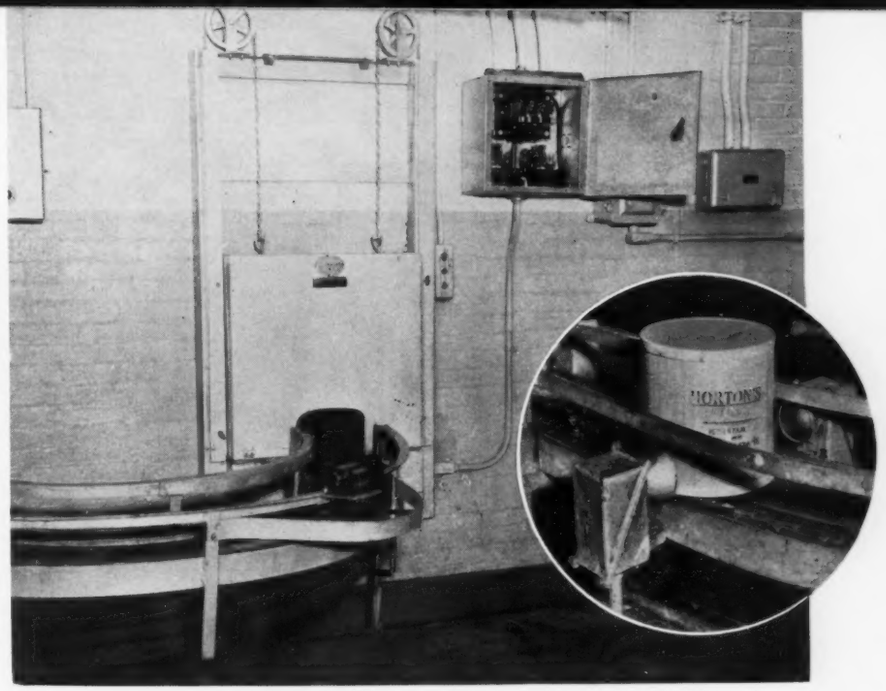
Grinder has three motors and magnetic chuck

Magnetic chuck (Walker make) is supplied with direct current through a flexible hard-service cable terminating in a reversing switch on the upper part of the machine. Rigid conduit wiring is provided to guard the wiring from mechanical injury, and Cutler-Hammer control of the push-button type serves each motor, each button and the chuck switch being accessible from one position of the tool operator.

Cold Room Conveyors Guarded by Phototubes

Application of phototubes on a conveyor to prevent its becoming congested has been installed in the Pioneer Ice Cream Brands plant by the Westinghouse Electric & Manufacturing Company. Two feeder conveyors supply one outgoing line from the cold room and when both feeders are busy it is possible to concentrate too many containers on the single outgoing line.

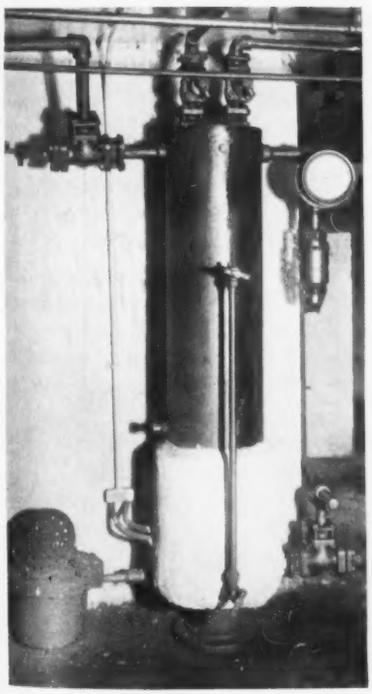
Two light sources and photo-housings are placed across the output line. If congestion occurs both beams are intercepted and the two contactors for the two photoelectric relays outside the cold room combine in operating one alarm. When congestion is indicated a worker bundles up with coat and boots and goes into the cold room to take care of the situation.



Electric eye warns of conveyor congestion

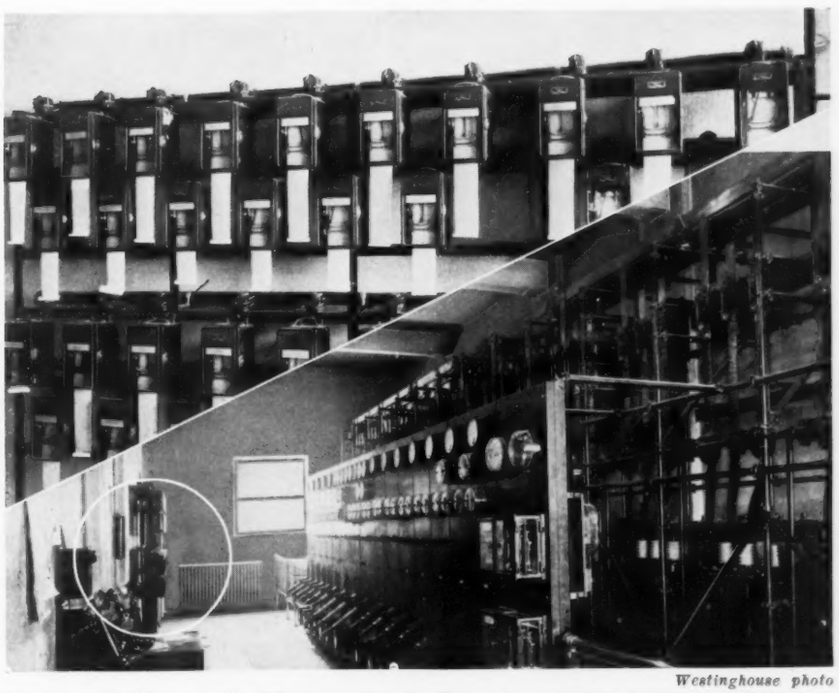
Because of the low temperature inside the cold room, 48 deg. below zero, the number of workers inside is kept at a minimum. The electric eye operates as unconcernedly as in a room of normal temperature, allowing the workmen to keep out of the lowered temperatures as much as possible.

Electric Heat Solves Reclaimer Problem



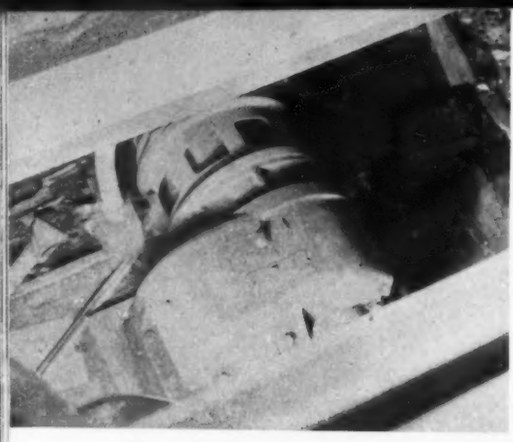
When the steam pipe inside this oil reclaimer burst the chief engineer of the Albany Packing Company, Albany, N. Y., was faced with the problem of either cutting through the bottom of the tank to repair the coil or using an external source of heat to reclaim the oil. He chose electric heat. A G.E. "Calrod" unit was selected, wound around the tank, heat insulated and the problem was solved

Cement Plant Operator Keeps Tabs on Production



Westinghouse photo

Battery of 36 recording instruments in Lawrence Portland Cement Company plant's substation. Connected into circuits of important motor drives throughout the mill. Faulty operation has been detected at times before operating crew had opportunity to notice anything amiss. Actual duration of shutdown and delays are manifest, as well as behavior of equipment under load



Three belt replacements annually avoided on conveyor

Gearmotors Trim Cost on Belts, Bearings

Glass plants are using gearmotors for conveyor and batch mixer drives. A 5-hp. gearmotor has been installed in a Pennsylvania glass plant to drive a conveyor. It replaces an older type motor driving through belts, sprockets and chains. Due to the location of the drive, it was subjected to a great deal of dampness, which affected the belt and caused an average of three replacements a year at a cost of $16 each. The gearmotor was installed in 1934 and has required no maintenance.

In another instance a 5-hp. gearmotor has been installed to replace an open type motor and three cast-iron gears driving an Austin cube batch mixer. The dust, consisting of sand and silica, was so abrasive that the maintenance on the equipment was unusually high. It was necessary to replace the gears at least once a year. Maintenance costs were as follows: Gears $50, labor $10, motor bearings $20. This makes a total of $80 annually. With the gearmotor it is expected that replacements will be a minimum.

Electric Heaters Built Into Tumbler

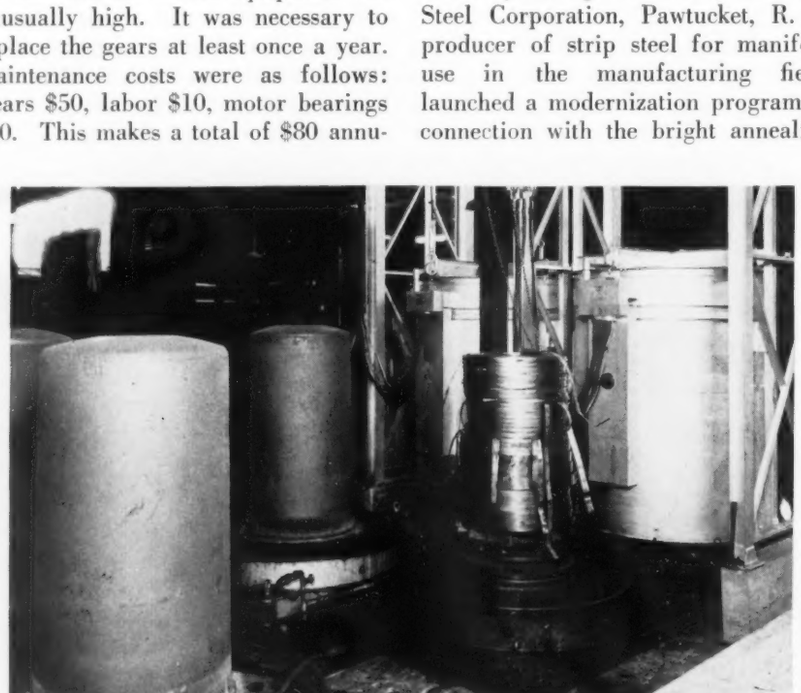
This "Lasalco Lectric Tumbler," which is used to dry small metal parts without resultant water marks, has twelve strip heaters mounted in the chamber between the inner and outer barrels to provide necessary heat. Controlled by a thermostat, these heaters are connected to the line through two slip rings mounted under the tumbler barrel, which rotates at 16 r.p.m.

•

Electric Furnaces in Annealing Plant

Five years ago the Newman-Crosby Steel Corporation, Pawtucket, R. I., producer of strip steel for manifold use in the manufacturing field, launched a modernization program in connection with the bright annealing of this material. Cold-rolled low-carbon, high-carbon and alloy steels are processed in this plant, and previously oil furnaces were used in the annealing division. So marked was the improvement in quality control and working conditions following the installation of a 90-kw. furnace that the company has extended its equipment year by year until today five such furnaces are in operation and a sixth, of 100-kw. rating, is soon to be installed. All the furnaces were built by the Westinghouse company and the operating schedule calls for 24-hour service continuously on a seven-day-per-week basis.

Each charge totals 5 tons normally and the work is kept in the furnace from 11 to 24 hours, according to conditions, low carbon steel taking the shorter heating period and high carbon the longer. Temperature exposures are between 1,200 and 1,400 deg. F. and in an atmosphere of hydrogen gas formed in the plant with the aid of an electrically heated dissociating equipment utilizing anhydrous ammonia as the source material.



Reports saving of from 20 to 25 per cent in over-all costs through electric annealing

The furnaces are placed over and removed from the charge containers by an electric crane and graphic temperature records are kept on every batch.

Telling and Selling

The Job to Do With Customers, Employees and the Public —A Theme Song for Next Year

By J. E. DAVIDSON*
President Nebraska Power Company

CO-OPERATIVE enlightenment can be carried on just as effectively in selling an idea as in selling merchandise. The ex-service men of America demonstrated this in their nation-wide fight for a bonus. They got the bonus. The effectiveness of an industry or a large group of people, through co-ordinated endeavor, can be duplicated locally by power and light companies, each presenting a true picture of its company, its policies and its problems.

What sort of presentation are you making to your public?

What kind of co-operative job are you doing with your employees?

What kind of co-operative job are you doing with your stockholders?

Keep your customers correctly informed

Customers are always interested in the affairs of a company which supplies them with many kinds of necessary services — economically, too. Your employees and your stockholders are especially interested in your company, for, in reality, it is their company.

Why should you expect to have the backing of your customers . . . why should you expect to hold their confidence and respect, if you keep them in ignorance of the truth regarding your company and the light and power industry, of which you are a part, while they are being constantly bombarded with so-called informational material, prepared and distributed by hostile forces? When the electric industry is attacked as a whole, each of your companies suffers individually.

The majority of our companies have worked spasmodically to furnish their employees with information, so that those employees can properly represent their companies. To Mr. and Mrs. Public the employee with whom they deal is the company, and when the employee is not properly informed Mr. and Mrs. Public may become erroneously impressed. Why should you hide your lamp under a bushel, while untruthful and derogatory statements about the scarecrow "power trust" and the damnable things power companies are supposed to have done go unanswered? Your employees are anxious to be informed. They are loyal; they are interested; they have pride, and they want to be able to discuss intelligently their company's problems with their friends, relatives, neighbors and business acquaintances. Why not make it possible for them to obtain the facts which they are rightfully seeking?

Educational program vital for industry

It is unfortunate that our electric industry, as a whole, discontinued its employee educational program. Many of us in this room have been in this business for more than a quarter of a century, and we still seek information. How can we expect our employees to know about our companies and the electric industry, after studying a few lessons some years ago? Some employees never had any lessons! The Nebraska Power Company has not stopped educating its employees and we never will!

Likewise, many power companies have sadly neglected their stockholders. The least our companies can do is to send a carefully prepared informative message with every dividend check. There are pamphlets and leaflets containing interesting and fitting statements that could be sent to your stockholder partners. Their attention should also be directed to pertinent radio addresses, magazine and newspaper articles. The late Senator Mark Hanna of Ohio was at one time being attacked by nearly every newspaper in his state. It was then that he said: "Give me one thousand informed talking men and women and I will give you all of the newspapers in Ohio."

With all of the employees and security owners properly informed, just picture what a job this intelligent army of men and women could do. What a force for good they could and would be, if a proper co-operative "Tell and Sell" plan were worked out for them.

Tenacity will make co-operation effective

When it comes to any activity or endeavor, co-operative or otherwise, tenacity is essential. You must keep everlastingly at it if you want to maintain good employee, good security holder, good customer understanding.

In making plans for greater sales or friendship building, may I admonish you not to have a plan executed by amateurs. This is one job that must be done well, or not at all.

I have always felt it was unfortunate that the disbanding of the old National Electric Light Association carried with it the elimination of most of the geographical divisions and many state associations. These subdivisions did very valuable work. They co-ordinated the interests of the separate companies of our industry, and, working hand in hand with the national organization as they did, they exerted a far-reaching influence which resulted in co-operation among electric associa-

[*Continued on page 124*]

* Abstract of address delivered before Indiana Electric Association, October 1, 1936.

New Telemetering Scheme for Intercompany Ties

Tennessee Develops Systems With Versatile Characteristics Functioning at 5,000 Cycles and at 60 Cycles, Also Affording Voice Communication

By E. E. GEORGE
Superintendent of System Operation, Tennessee Electric Power Company, Chattanooga

THE Tennessee Electric Power Company put into satisfactory operation on May 15, 1935, a telemetering installation between Nashville and Chattanooga, operating over 180 miles of company-owned telephone line, located largely on transmission right-of-way and exposed to severe induction. In view of the unusual scheme involved, fine operating record, low first cost, freedom from maintenance and large operating margin available, a detailed description may be of interest to those faced with long-haul telemetering problems. Satisfactory operation of this equipment led to the development, in cooperation with a power equipment manufacturer, of two other forms of long-haul telemetering, involving more conventional equipment. One of these is also described herewith.

Some types of telemetering equipment which have given excellent service over short distances are compensating for series line resistance and for equipment characteristics, but are seriously affected by variable shunt leakage, and are therefore generally limited to communication circuits in cable. The torque balance scheme is of this type, but its excellent performance record in cable indicates that it might be used on high-grade, open-wire circuits of short or moderate length. However, longer communication circuits frequently involve repeating coils, so that alternating current rather than direct current is necessary. Furthermore, a long-haul scheme must operate in spite of the variable transmission characteristics of the communication circuit, caused by variable line leakage and changing circuit connections.

The effect of variable attenuation can best be eliminated by transmitting variable frequency rather than depending upon variations in volume. Heretofore telemetering schemes involving variable-frequency carrier or variable-frequency modulation of the carrier have been complicated and expensive. A compromise scheme, consisting of a direct-current impulse system, which was formerly used on a 120-mile open-wire telephone circuit, was found to be unsatisfactory from an operating standpoint due to variable characteristics of electrolytic condensers and rectifiers, to rectification of line noise, to high current required from the terminal storage batteries, to deterioration of the contacts on the sending watt-hour meter, etc.

The economic advantages of telemetering having been clearly shown by experience with two previous installations, it was decided to make a third installation between Chattanooga and Nashville.

Eliminating for the time being the sending and receiving equipment, it was apparent that the problem of providing a satisfactory channel was simply a communication problem and that for the usual types of telemeter it was a telegraph problem. The old Arlington-Chattanooga telemeter was simply a telegraph system sending dashes at a variable frequency of 1 to 5 pulses per second. Investigation showed that the Bell System was using a carrier telegraph scheme that would operate over telephone lines without interference with talking or with ringing.

There was some question whether standard insulating transformers would interfere materially with the flow of carrier current, but tests showed that

Many schemes have been developed and put into actual use for remote metering of power circuits over short or moderate distances, but until recently there have been no practical remote-metering equipments likely to be met within transmission practice, particularly in the metering of intercompany tie lines where the tie may be located 100 or 200 miles from the dispatching office. The sending equipment, receiving equipment and type of signal heretofore used have not been adaptable to commercially available long-distance communication channels, much less to privately owned long-distance telephone circuits exposed to severe induction, or to power line carrier channels. Herewith are the details of a scheme that overrides these shortcomings.

the loss at 5,000 cycles was satisfactorily low.

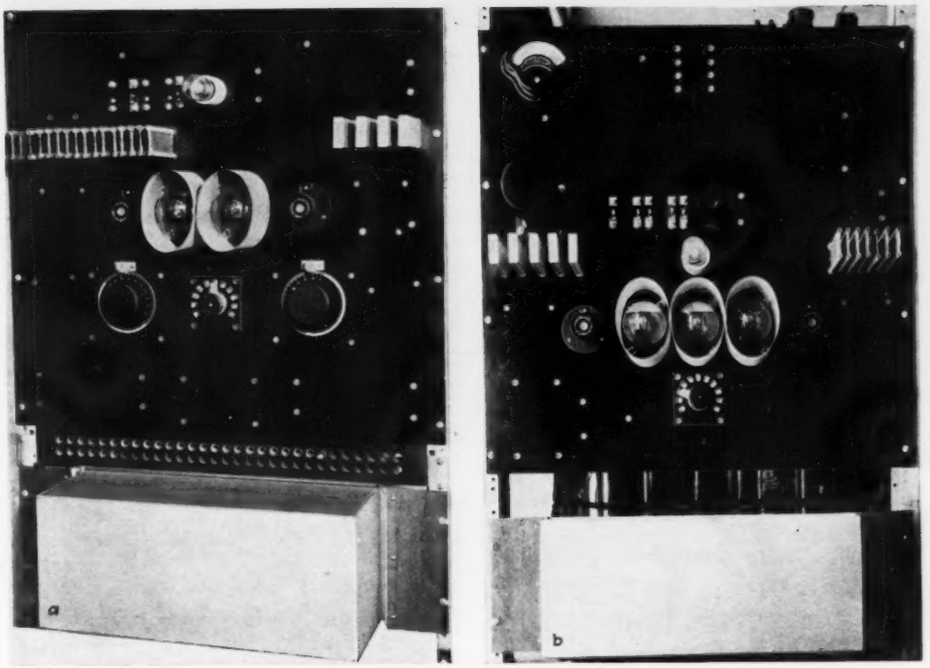
Equipment of Western Electric manufacture was used in building up a one-way carrier telegraph system of 5,000 cycles. The various units of the equipment were ordered separately and mounted and wired locally. The equipment was ordered in March and cut in service May 15, much of it being available from stock.

Operating principles of 5,000-cycle telemeter

The sending equipment was designed to be operated by a telegraph relay, but is at present operated by telemetric contacts on the watt-hour meter. The receiving equipment has an output relay and this operates a frequency-counting device similar to that used in earlier types of impulse telemeters. The principle of operation is therefore simple. The watt-hour meter on the Wilson Dam line at West Nashville has a cam on the shaft which opens and closes a contact every time it turns around. This contact opens and closes a short circuit on the output of an oscillator—a radio-frequency generator. This oscillator is connected to the "hot" telephone line at West Nashville on the station side of the insulating transformer and the frequency used is such that it is transmitted through the insulating transformers, line and repeating coils to Chattanooga without very much loss.

At Chattanooga this series of pulses or dashes passes from the telephone line into a radio receiver consisting of two amplifier tubes and a detector. The detector output operates a polarized relay. This is the only mechanical or moving contact between the watt-hour meter at West Nashville and the dispatcher's office in Chattanooga. This relay is of the type used in commercial telegraph service and will stand more operations with less maintenance than any other type of relay manufactured. Originally the telemeter-receiving relay operated a magnetic impulse telemeter, but this has been replaced by a simple arrangement of condensers and resistances controlling the current into a thermal millivoltmeter calibrated in thousands of kilowatts.

The carrier frequency used in this telemeter (which is really a carrier telegraph system) is 5,000 cycles. In this range the human ear is rather insensitive and a moderate volume at this frequency does not interfere with conversation.



Terminals of new telemeter channel

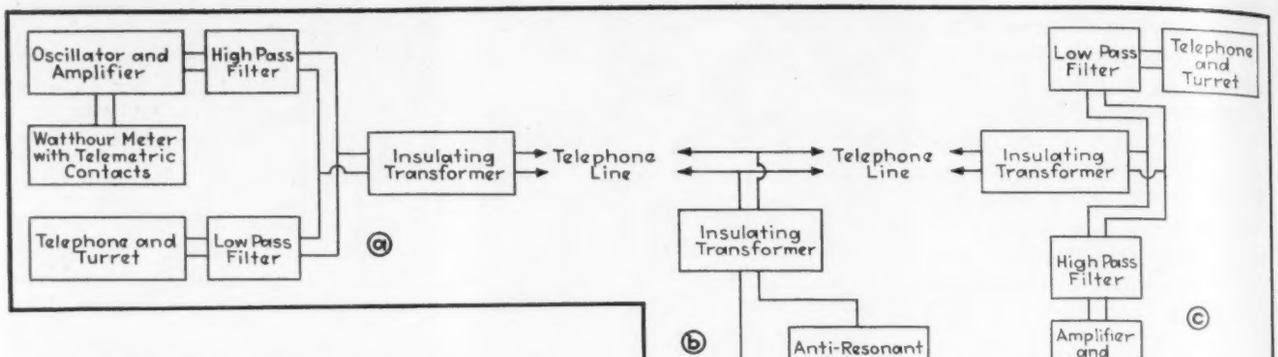
(a) Sending equipment at Chattanooga; (b) Receiving equipment at Chattanooga

Avoiding interference between communication and telemetering

The filtering arrangement used with the 5,000-cycle telemeter is relatively simple. At the terminal stations, particularly at the sending end, some filtering is necessary to keep the voice circuits (which are in parallel with the telemeter circuits) from absorbing too much of the telemeter output, thereby interfering with conversation and increasing the volume of telemeter signal necessary. If the filtering were placed only on the communication circuit the telemetering equipment might shunt the voice impulses too much. Therefore a band-pass filter is essential on most communication circuits used jointly for telemetering and for voice communication. Such a filter is used in this installation. It consists of a high-pass and low-pass filter in parallel, with a cut-off point around 4,000 cycles. The section connected to the telemeter passes frequencies above 5,000 cycles with very little loss, but reduces voice frequencies to less than 1 per cent of their original value. The portion connected to the telephone instrument and turret passes frequencies below 3,000 cycles with little loss, but renders the telemeter pulses inaudible. Each type of service is therefore restricted to its own equipment without interference or appreciable loss due to the presence of the other. A similar band-pass filter is installed at the receiving end. The high-pass portion of the filter is particularly necessary at this end, because no other selective devices are used in the receiving amplifier and it is necessary to prevent the amplifier from operating on voice and ringing signals.

After taking care of the terminal equipment by the selective devices described above there still remained the problem of eliminating interference at the five way stations on the telephone line. It was found that the telemeter transmission loss was not increased much by the way stations normally, but that there was some loss with way station receivers off the hook. The interference from the telemeter, especially near the sending end, was considered too high for good communication, so the decision was made to filter all way stations. These way stations were already equipped with insulating transformers and the filtering was done in the low side by simply adding a 5,000-cycle anti-resonant circuit in series with one of the two phone leads. This anti-resonant circuit consists of an Aladdin "Poly-iron" core coil bridged by a mica condenser. This equipment occupies only a few cubic inches and cost less than $10 per station, so that way station filtering was a minor problem.

A schematic block diagram of the



5,000-Cycle telemeter comprised largely of standard facilities

(a) The sending end. The telemetric contacts in the sending watt-hour meter are of the commutator or photo-electric relay type. (b) Telephone way station. (c) Receiving end terminals in thermocouple indicator.

Nashville-Chattanooga telemeter and associated equipment is shown herewith. The watt-hour meter (on the Gorgas-Wilson Dam-Nashville tie line) is standard except that it is equipped with a differential so as to provide a progressive rate of pulsing on the contact device from maximum "out" to maximum "in" on the tie line. The contacting device has to handle only 5 or 10 milliamperes.

Standard filter elements

Realizing that filtering is an art within itself, no experimental or development work was done with any filtering schemes. Instead two Western Electric 28-B filters were purchased as an integral part of the telemeter equipment. This filter is of the band-pass type, consisting of a high-pass and low-pass filter in parallel. The oscillator and amplifier consist of two vacuum tubes of the type used in telephone repeaters. This is probably the first instance where this type of communication equipment has been used for power service, but its performance has been excellent and maintenance has been nil. The idea of using, wherever possible, electronic equipment already developed and tried in practice has been thoroughly justified.

The insulating transformers were of course already installed on the telephone line for communication service and were the standard 25,000-volt rating. The new way station equipment, which consists only of a single-stage anti-resonant circuit tuned sharply to telemeter frequency, has already been described.

The telephone line from Nashville to Chattanooga is unusual in several respects. It connects two important offices of the company and in addition serves two power plants and three major substations. The Bell private branch exchange at the Nashville office of the power company is a way station on the line. At Chattanooga the line terminates in a turret serving the general office and connectible to all private lines of the company, as well as to city and toll facilities. Although about 100 miles of the line is on transmission right-of-way with a 110-kv. circuit, 30 miles on the Chattanooga end is on highway. An insulating transformer is placed in the line at Cleveland, isolating the hot section of the line. This insulating transformer is used as a phantom coil because the Chattanooga-Nashville telephone line forms one side of a phantom circuit, with the other leg going to Blue Ridge and the phantom to Parksville. At the Chattanooga office the line terminates in standard 91-A phantom coils. The 28-B filter at the Chattanooga end is exactly like the one at the Nashville end.

From the high-pass section of the filter the telemetering circuit passes through a two-stage amplifier and a detector, again using three tubes of the type used in telephone repeaters. The output relay is a Western Electric 209-FA, which is of the polarized type with d.c. bias, operating on 6 mils d.c. This relay is satisfactory for speeds up to 25 pulses per second or above, so that if greater sensitivity and speed of response in telemetering is desirable the present maximum pulsing rate of 5 per second could be stepped up materially.

The equipment described above has had one year's service to date. Its performance has surpassed all expectations. There have been no interruptions or failures except the failure of the open-wire telephone line during storms, power contact, etc. No tubes have been replaced, no adjustments have been changed, no periodic tests have been made, and there is no evidence of wear or deterioration. The only maintenance has been the cleaning of the contacts on the output relay every few months, and the necessity of this maintenance has likely been eliminated by the recent addition of a high series resistance and ballast tube in the supply from the storage battery to the output relay and frequency metering network. The equipment is particularly insensitive to variations in line leakage, changes in telephone connections, induction, noise, etc. This is probably due in large measure to a receiving circuit developed by the Bell System from long experience in carrier telegraph service on open-wire phone circuits. The leeway in operating margin under all conditions indicates that the scheme could be used on open-wire lines up to 300 miles without repeaters and on a transcontinental basis if properly repeatered.

Terminal equipment meets high standard

Highly satisfactory operation of the above equipment led to the development of terminal equipment to meet the high standards set by the channel equipment. As first installed, the output relay operated the receiving equipment formerly designed for a direct-current impulse telemeter system.

Reception was later materially improved by using the scheme described by Lapham of the U. S. Bureau of Standards in the *Proceedings* of the Institute of Radio Engineers for July, 1935. This scheme of charging and discharging a condenser from a d.c. source into a microammeter has been used in other applications for years.

Straight-line calibration was highly desirable but could not be obtained as long as the pulsations in the condenser discharges were smoothed by leaking through a high resistance. The matter of getting the pulsations out of the indicating meter reading was one of the most difficult problems in the whole telemetering development, but was solved by L. E. Smith of the Laboratory Division of the T.E.P. Company, who conceived the idea of thermal storage as a substitute for resistance or magnetic damping. The first device used was a bridge consisting of tungsten lamps, but it was soon found that a thermocouple type milliammeter or milli-voltmeter fulfilled the requirements better than anything else. The type of thermocouple used in portable instruments has sufficient thermal delay to give an almost steady reading on a milli-voltmeter even with the pulsing rate on the output relay as low as one per second.

Uses photo-electric amplifier

The original sending equipment consisted of telemetric contacts on a watt-hour meter and was designed for d.c. impulse telemetering. Development of an improved sending device was turned over to the power manufacturer, who worked out a photo-electric amplifier and relay for this purpose. In the photo-electric scheme the watt-hour meter disk has holes at equal intervals, and as the disk turns these pass pulses of light from a lamp onto a photocell. The photo-electric output is amplified to operate a 215-E or 209-FA relay, which keys the carrier output of the oscillator by shorting it at the grid of the amplifier.

The original differential on the watt-hour meter was a mechanical one driven by a Warren motor. The new sender includes an electric or magnetic differential using regulated voltage on an additional watt-hour meter element to give a moderate no-load speed.

60-cycle telemeter

The various steps outlined above provided a thoroughly adequate intermediate frequency telemeter — one adapted to work just above the voice range and therefore especially suitable to communication circuits. Naturally, discussion arose with the power manufacturer regarding similar improvements in low-frequency and in high-frequency telemeters. The latter could be used with power line carrier (100,000 cycles or thereabouts) and the former showed promise of being cheaper on communication circuits of moderate length.

Since the sending and receiving terminal equipment described are connected with the channel equipment by relays, a power line carrier telemeter system is available by adding to the terminal equipment a carrier oscillator, carrier receiver, and output relay —all of which have long been available. Such a scheme of carrier modulated at variable frequency is considerably different from the variable-frequency carrier scheme developed by Logan of the Georgia Power Company and described in *Electrical Engineering*, January, 1936. Both the variable-frequency carrier method and the variable-frequency modulation method have different outstanding advantages, making the choice between them dependent upon local conditions.

Development of a low-frequency telemeter system involved much labor and field work, carried on jointly with the power manufacturer. This work was completed a few months ago and the final equipment put in service on the Arlington-Chattanooga telemeter, which indicates in the dispatcher's office in Chattanooga the load on the Carolina Power & Light Company tie at Arlington substation in Knoxville.

No ringing interference

After much analysis and testing 60 cycles was chosen for the low-frequency system. The filtering has been perfected to the point where there is no interference with 20-cycle ringing, 135-cycle ringing, or with conversation. Under ordinary circuit conditions the 60-cycle signal is inaudible, being less than line noise (on a quiet highway circuit). Under severe conditions the telemeter volume can be raised several hundred per cent and the telemeter will operate O.K. on a line too noisy to talk over. This is accomplished by raising the detector bias to offset the line noise. The receiver has automatic volume control and phenomenally selective gain at 60 cycles.

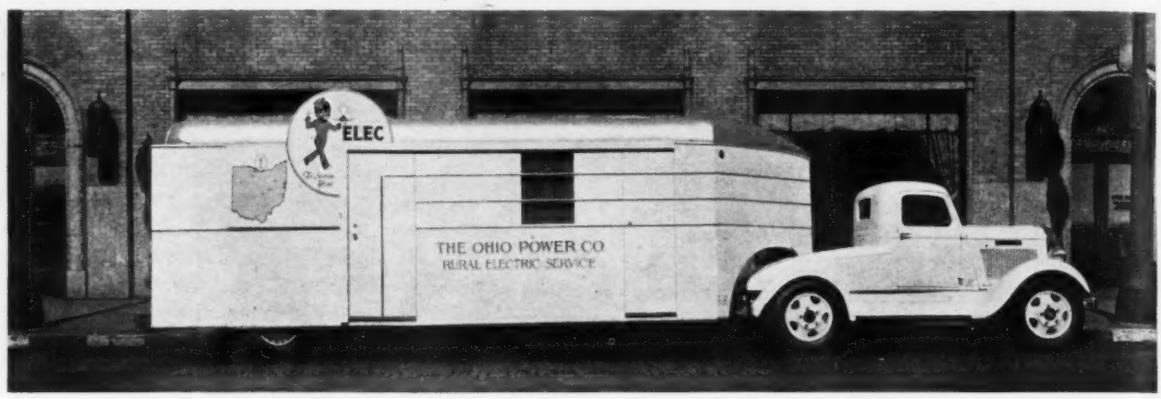
The 5,000-cycle scheme is less affected by ordinary variations in line conditions and is more automatic in its adjustment to such variations. Furthermore, this scheme can be repeatered with any type of telephone repeater adapted to this frequency range. The 60-cycle scheme would probably require mechanical relay repeaters for extreme distances. The 60-cycle scheme is somewhat cheaper and simpler for the usual power company communication circuits. No detailed wiring diagrams are shown, since the above equipments are now commercially available.

These Schemes Have Advantages

Both the 60-cycle and the 5,000-cycle telemeters have the following advantages in common

1. Either equipment will work through phantom coils, insulating transformers and commercial repeating coils without requiring coupling or by-pass condensers.
2. Short links of underground cable may be used, especially with the 60-cycle system.
3. Very low power is required, eliminating large or expensive tubes.
4. The power requirements at the sending end are very low, permitting the equipment to be supplied from the same potential transformer used for high-tension metering.
5. The receiving equipment does not require any 60-cycle supply, but operates off of standard station storage battery.
6. Both systems use a frequency range not now used for any other purpose, and hence permit the simultaneous use of the same circuit for telemetering and communication purposes. It is understood that a modification of the 60-cycle scheme using power line carrier permits carrier-relay protection as well as telemetering with the same carrier-current equipment.
7. Either type will operate over any telephone lines up to any length over which communication can be carried on.

Electrified Farm Travels



Taking the Ideal Farm to the Farmer Spreads the Gospel Easier Than Relying on the Farmer to Do the Traveling

WHAT may be called a mobile electrified farm, consisting of a trailer with a power unit and containing a large variety of electrical appliances useful on the farm, has been developed by the Ohio Power Company. This trailer has been in use for a short time on a schedule which includes the county fair circuit of Ohio. At the Scioto, Crawford, Van Wert and Harrison county fairs 18,367 adults passed through the coach, which far exceeded our expectation of the interest that might be aroused by this demonstration.

Ohio Power Company is a subsidiary of the American Gas & Electric Company. All companies in this system have a common policy in that they do not engage in a general merchandising business. The American Gas & Electric subsidiaries sell only those major appliances which, in the opinion of the management, require pioneering effort, so that the companies only actively sell electric ranges and electric water heaters. While both of these appliances are installed and in operation on the rural demonstration coach, no effort has been made to promote their direct sale from the coach.

In addition to these two major appliances there are 38 other appliances connected and in operation on the truck which range all the way from the usual household devices, such as the toaster, to unusual farm applications, including a fly electrocutor and a unit of electrified fence. See the list under the accompanying illustration.

Very little of the equipment on the coach has been purchased, most of it being consigned by the manufacturers, jobbers or dealers, and it is the intention to change the appliances from time to time so as to present a variety of lines to our customers. The matter of consignment of equipment extended even beyond our original expectations, as we thought it would be necessary to purchase certain items. I visited the store of a large dealer, for example, with the intention of purchasing certain of the machine shop equipment, and after explaining the use to be made of the equipment I was told by the manager that it would not be necessary for me to buy it, but that he would be glad to consign it indefinitely for demonstration purposes.

We are attempting the fullest co-operation with the dealers in presenting to the public a display of equipment for demonstrating many uses of electricity on the farm and in the home which will help to make home and farm life more comfortable and profitable. From the selfish standpoint of the utility, we are selling electricity and its many advantages.

In the coach there is a large sign which reads: "This Display Furnished Through the Courtesy of the Manufacturer and Your Local Dealer." At or near each piece of equipment there is attached a small card giving the name of the appliance and the price range for good merchandise of like nature. All persons visiting the coach are given a postcard which contains a list of most of the popular applications of electricity on the farm and they are asked to check those in which they are interested so that they may,

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Much publicity has been given to intensively electrified farms, especially the one near Washington sponsored by R.E.A., N.E.M.A. and the Virginia Electric Power Company. The Ohio Power Company won't wait for Mohammed to come to the mountain, so it takes the mountain around to the state fairs and rural areas for quickened dissemination of the idea. A trailer is packed with what the farm and its kitchen lack.

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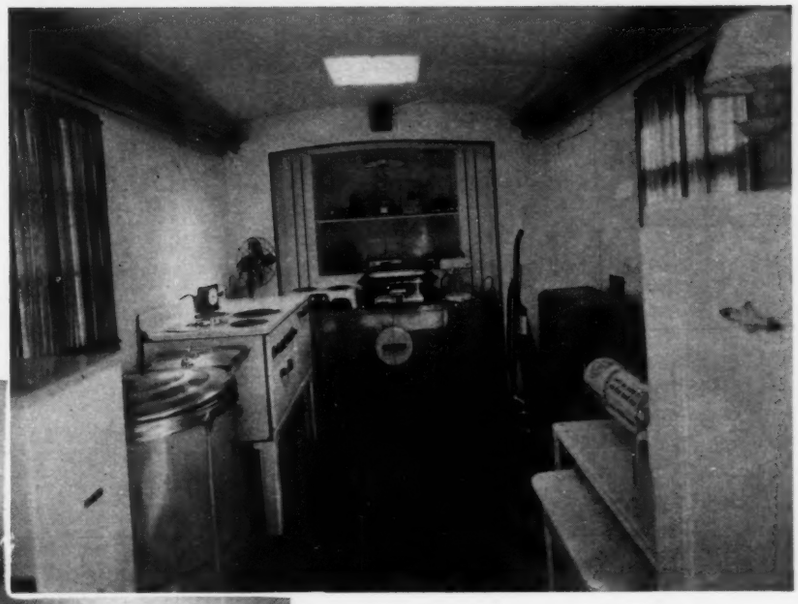
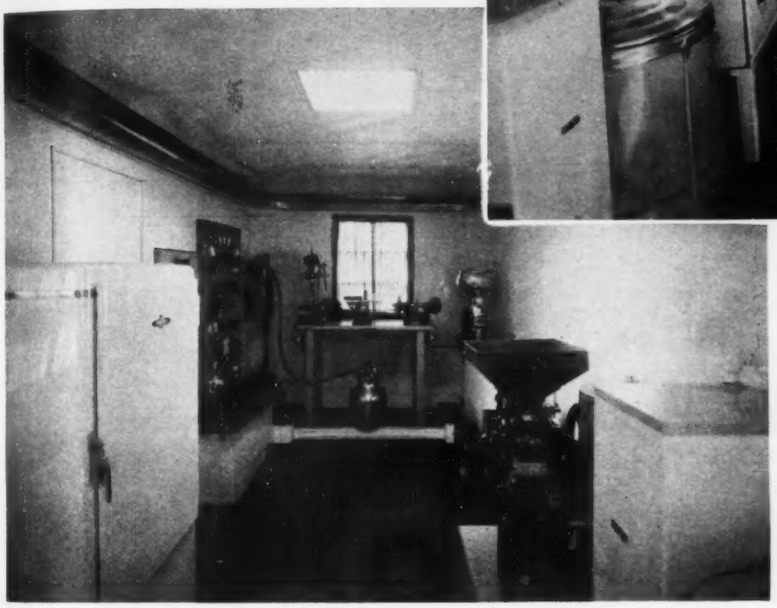
in Trailer

By R. K. DERRY

Rural Service Supervisor Ohio Power Company, Canton





Kitchen and farm buildings exemplified. Here is what is installed in the trailer

Range, refrigerator, water system, water heater, ironer and bench, vacuum cleaner, hand vacuum cleaner, radio, washer, roaster and grill, food mixer, waffle iron, sandwich grill toaster, coffee maker, percolator, hand iron, bottle warmer, warming pad, portable room heater, curling iron, two-unit hotplate, I.E.S. lamp, lumiline lamp, oscillating fan, miniature model furnace complete with Force air-conditioning unit and controls, feed grinder, hotbed, separator, milking machine, fly electrocutor, electric fence unit, brooder, shop workbench, soldering iron, bench drill, bench saw, bench grinder, wiring devices display board, heating unit display board.

without obligation, receive information concerning them. At the four fairs in Scioto, Crawford, Van Wert and Harrison Counties approximately 1,400 prospects for the various appliances and equipment were received.

Very careful consideration has been given to the manner of distribution of prospects among the dealers. The truck is in charge of an experienced salaried employee who works with the rural representative in the particular territory in which the truck may be on exhibition. All prospects are turned over to the rural representative and it is his duty to distribute them fairly and equitably among the various dealers in the immediately contiguous community.

In advance of the appearance of the rural demonstration coach in any community local newspapers are supplied with a descriptive story and cuts of the coach. When customers visit the display literature is handed out on a number of the appliances on display as well as on similar appliances made by other manufacturers. In some cases this literature is furnished direct by the manufacturers, but local dealers in many instances prefer to supply it and have their names imprinted on the circulars. General Electric Company's bulletin entitled "The Cost of Operating Electric Farm and Home Equipment" and Westinghouse Electric & Manufacturing Company's bulletin "Wired Help for Farm and Home" are being used for distribution to a restricted group of good prospects. The only piece of direct company literature being given out is a so-called rate disk which enables the customer to determine readily the number of hours various appliances will operate for a cost of 5 cents.

The rural demonstration coach will complete its schedule of county fair exhibitions by the end of October, after which it will be taken to Columbus for the ninth annual Rural Electrification Conference sponsored by the agricultural engineering department of Ohio State University, where there will be an opportunity for representatives of other utilities and rural agents to examine this interesting display showing the application of electricity to the farm.

In selecting the equipment to be installed on the coach we have been guided by a desire first of all to have every piece of equipment connected and in operation while on display, and, secondly, to provide as many popular applications as possible within the limited space available. An examination of the accompanying illustrations will indicate how successful we have been in doing this. It is our intention to keep an accurate check of the inquiries on every appliance on exhibition, and just as the merchant eliminates from his shelves articles of merchandise on which there is not a reasonable turnover, so we will eliminate any appliances on which there is no evidence of popular interest.

The rural demonstration coach has hardly been in operation long enough for us to make accurate estimates of the cost of operation or to determine fully its value as a device for the promotion of rural elctrification, but so far we are very much gratified by its public reception and we find that it has been enthusiastically received by the dealers throughout the territory as evidence of further co-operation with them by the company.

Editorials

L. W. W. MORROW . EDITOR

How to Electrify Industry

THIS industry faces a big industrial market. It has new things to sell industry. It has improved equipment to replace old equipment. But how many industry salesmen are completely informed and able to sell industry on the consulting engineering basis required? How many can go into a soap, perfume, cheese, metal-working or other factory and make a report to the managements that will show economic results of replacement and the use of new electrical equipment and methods? Study shows that very few electrical manufacturing salesmen or utility power salesmen have this knowledge and training.

In the old days, when steam engines, drive shafts, belts, pulleys and oil lanterns were replaced with electrical devices, the industry sold by doing the type of engineering selling required today. But in the later factory-building era sales were specialized and subdivided on a product basis and multiple product selling as well as engineering selling decreased. Now the cycle is back with a replacement market unequipped with its own engineering staff and dependent upon the electrical industry for consulting and selling service. Industry knows that it must use more power and machinery, but it doesn't know what or how.

Our suggestion for approaching this market is based upon decentralization and co-operation. For example, utilities could well afford to make preliminary surveys and tests of factories to get data on the most promising prospects. Local "industrial electrification" groups should be formed by representation of utilities, manufacturers, jobbers and contractors. These local groups could then go to work on the most promising prospects to develop a report for factory managements that would show what to do and why. The final sales job would be competitive, but the volume of business created would give all a share.

When one thinks of the old motors, controls, wiring and drives in industry that are obsolete; when one thinks of lighting, welding, heating, air conditioning, ventilation as new things to introduce; when one measures the business that would come from taking advantage of this marketing opportunity—then, indeed, should the industry awaken and change its organization to go after the business. This issue gives a sample of what is being done. Its purpose is to stimulate the growth of this new movement to modernize and electrify industry. Electrification will be accepted on its merits if the merits are made known.

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Is Big Business Worse Than Big Government?

POLITICS calls out the dogs and sics them on big business. The immediate ankles being nipped are those of the electric utilities. For a time other examples of bigness in business felt that they would be spared, but now their skins are shivering in fearful anticipation or have already felt the fangs.

The politician has discovered how very potent in his purposes are the burblings of the social theorist who says that all our ills result from bigness as it fosters the megalomania of captains of industry, as it develops mass production and grabs the profits therefrom and as it turns out to starve hundreds of thousands of men displaced by machines. All along the line the yelps and bites of sharp-tongued and sharp-toothed criticism annoy and beset the titanotheres of business and industry.

Strangely enough, but on second thought not so strange either, bigness in government appears to be exempt of vice, to be of virtue thrice compounded. "We have forged new instruments of power," intones the perfect radio voice, and continues, saying that the people have nothing to fear from these instruments since they will be used only for good in the holy hands that made them. Big government, powerful yet tender, brooding over its subjects, making the way easy for them, securing them from trouble, wiping their noses and tucking them into bed.

Of course the men who run big government are finer, kinder, wiser than the men who operate big business. Otherwise these "new instruments of power" might be used for oppression, as the strength of big business so often is. And how we have suffered from the crimes of big business. Suffered from being obliged to live on a higher scale of comfort than any other nation has ever known. Suffered from having more automobiles than all the rest of the world together. Suffered from the use of electricity, which in a thousand ways private industry has forced upon us at constantly decreasing price.

In comparison with those of the blithely happy peasants and industrial workers of proletarian Russia, our sufferings are indeed intense. Measured against the carefree well-being of Antonio and Fritz in Fascist

Italy and Nazi Germany, our state of life is truly desperate. In these Utopian commonwealths big business commits no crimes because big business does not exist. There is only big government, wielding its "instruments of power." It looks as though, as Henry Wallace says, "America must choose."

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For Balanced Progress

HARVARD'S tercentenary leaves many profound impressions upon those who shared its proceedings in person or by broadcast. Unity of scholarship, interdependence of research and industry, cosmopolitan aspects of higher education, civilization's need of science, arts, free inquiry and teaching were outstanding facets of the university's colorful birthday celebration. President Conant's fine portrayal of the need for proper balance in university activities struck a responsive chord in the broader thinking of engineers and scientists. Dr. Frank B. Jewett's skillful delineation of the social implications of communication engineering and research sounded a heartening note of utility service and idealism by no means confined to telephony.

The extraordinary congress of savants at Cambridge and their advanced utterances revealed the inclusiveness of progress in a momentous hour of history. If research and education were at the front of the stage, the light of leadership emphasized the basic value of achieving fundamental truth in a thousand fields of human activity. If the future of American universities was brightened in the focus of Harvard's rededication to service—and who can question this—the outlook for far-reaching gains to mankind from their contributions to human welfare has been gloriously clarified.

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Crowding the Reserve

IN THE week before Christmas of 1929 electrical energy production in central stations rose to 1,860,000,000 kw.-hr. and set a record that stood unsurpassed for nearly six years. Since October, 1935, that record has been exceeded in every single week but two.

During the past several months production has averaged about 16 per cent above 1935. If this 16 per cent lead is maintained—it seems to be increasing rather than decreasing—the output during the preholiday week will be at least 2,320,000,000 kw.-hr. That is 24.5 per cent more than in 1929. Moreover, the gain over 1929 has lately hung persistently at 21 per cent. Since the autumnal rise in that year was seriously slackened by the first stages of the depression, it may be expected that the next few months will bring a gradually broadening excess, compared with 1929, that will easily account for the additional 3.5 per cent.

How does this 24.5 per cent compare with the changes in installed capacity? At the end of 1929 the aggregate generator rating was 29,558,637 kw. At the end of July, 1936, it was 33,477,500 kw. That is an increase of only 13 per cent. All figures here used are, for consistency, from the same source, the Edison Electric Institute.

Of course this does not portend a "power shortage" in December, in the sense that the industry will not be able to meet all demands. There was reserve capacity available in 1929. There undoubtedly will be in 1936. Such reserve is necessary in an industry that provides an indispensable service. In agriculture lack of foresight can be corrected (at a price) by importing grain, but we cannot import kilowatt-hours from Argentina.

The figures do indicate that the power industry is going to have a narrower margin of reserve equipment than it had in 1929, that it will probably have to transfer more energy across state lines—a taxable misdemeanor if not a major crime in the eyes of some persons—and that the companies must be not only enabled but encouraged to start needed construction at once, to forestall the real prospect of a critical shortage in 1937.

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Modern American Homes

SOME in the electrical industry decry the effort to promote public acceptance of the modern American home. A home designed from the inside out. One that embodies new building materials, insulation, complete electrification, air conditioning and other new contributions to make homes more beautiful and more convenient. It is said that this is a futuristic dream. It is said that it distracts attention from efforts to sell ranges, refrigerators and other devices. These negative people say that architects and home owners are so far from accepting this ensemble idea that money is wasted in trying to convert them.

These people are wrong. Yet we agree that possibly $100,000,000 is needed to get acceptance of the modern home idea. It is no piker undertaking. But it is worth the money and the effort. It is the logical culmination of all our efforts to sell home owners new things and new appliances. If they accept the ensemble they accept the units, and this means low-cost unit selling as well as large volume selling.

It is a shortsighted policy to "knock" the modern home idea. It is a worthy project that should have the wholehearted support of every one. More than this. If those who will gain from the program will put up money to promote it, they will expedite the movement. Why wait ten years to do a job that is a good business venture right now?

Windmills and Politics

IN THE days before radio and loud speakers there was generally a pitcher of water on the speaker's rostrum. When the orator attempted to moisten his dry and aching throat it was considered the height of humor for some one to scream:

"Mr. Chairman—I object to windmills being run by water power."

Out in Sioux City, Iowa, the boys and girls don't see very much humor in that idea today, because they are very busy making windmills, and they don't like the idea of water power plus rural electrification taking their jobs away.

It all grew out of the fact that the radio manufacturers wanted to sell receiving sets to farmers, who were perfectly willing to buy them, but had no electricity. So finally some one had the bright idea that a small windmill, plus a storage battery for each farmer, would solve the problem.

The device was worked out, and now a company in this little Iowa city is working nights trying to supply the demand. It has already sold 200,000 of these windmills, coupled up with little dynamos, and as a result the radio manufacturers have sold just 200,000 sets more than they otherwise would.

Like everybody else who develops something that finds almost a readymade market, however, the makers are not satisfied. If a farmer will buy one windmill and dynamo to provide enough juice to run his radio, so they opine, why will he not later buy a couple more to provide his household with electric lights?

After watching one of these little affairs operate a lumberman up in Northern Michigan fabricated a windmill of his own, with huge galvanized iron blades, which feeds so much power into a dynamo that he is able to run a circular saw with it!

SO FAR this new enterprise is modest. It sells the windmill plus the dynamo to the farmer for $15. The storage battery is extra, and so, of course, is the radio. But the farmer gets a strong selling talk on economy. Operation, he is told, will cost nothing except a little oil occasionally. Dame Nature supplies the power. About every seven years, on the average, he will have to replace the storage batteries.

They don't tell him much about the radios, but of course they hope to sell him a new one every few years, with all the latest improvements.

Another reason is that there is not much competition in the windmill business, yet, and being human they are not trying to develop it. So while the windmill makers happen also to be tremendously interested in one brand of radio, they are doing nothing that might result in rival radio manufacturers going into the windmill business.

There is nothing new about power from windmills, of course. They have been used in Holland for centuries, as every school child knows, and there used to be a fair sprinkling of them in this country. As a matter of fact the makers estimate that in all but a few scattered sections of this country, notably North Carolina, Louisiana and Arizona, there is plenty of wind to make their particular device practical.

So they are thinking in terms of millions of windmills—windmills almost as plentiful in the country districts as Ford cars.

And now comes Rural Electrification to turn their rosy dreams into nightmares.

"The government puts up the money to build the dam," said an official of the windmill company to the writer. "Then it has more electricity than it could give away in that community. So then it subsidizes a rural line which could not possibly pay to carry the current to remote quarters. And it boosts my taxes to pay for all this. I suppose the next logical step—if we sold enough windmills—would be to put a special tax on windmills so as to help pay the losses on rural electrification. It would be on all fours with what the government is doing now—taxing the life out of the electric companies and using the money to build up competition for them."

THIS idea of dragging up a device which most of us had rather thought obsolete and making something of it—à la windmills—suggests that there is nothing new either about using the power of the tides to make power. To hear all the talk and magazine articles about the Passamaquoddy project one might think that never before in the world's history had the idea of harnessing the tides been attempted.

Actually there were waterwheel mills using tidal power before Franklin D. Roosevelt was born, and they didn't have any necessity for a Diesel or steam engine to take up the load when the tidal power plant was not working.

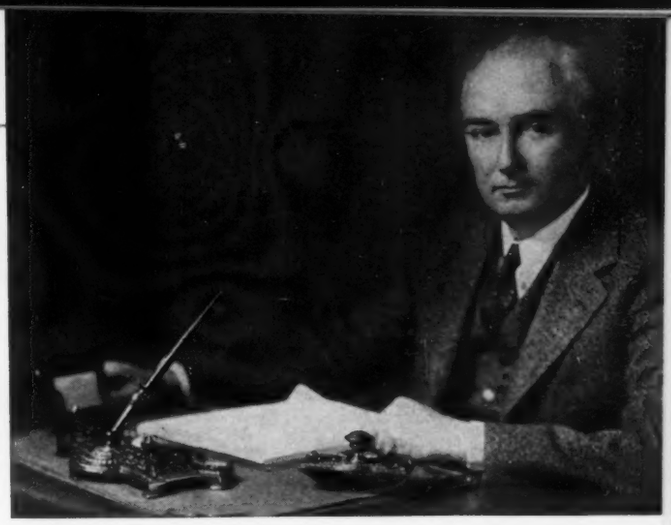
Down in Mathews County, Virginia, when this writer was a little boy, there was a tidal mill which looked so old at the time that it must have been built before the Civil War. Mr. Roosevelt's district attorney in the District of Columbia could have told the Quoddy engineers all about it, for he lived as a boy less than a mile away.

Perhaps that particular mill was a success because it never occurred to the owners to try to grind all the corn in eastern Virginia. They were satisfied with enough power to supply their immediate market. Probably it was not entitled to a very high rating for mechanical efficiency, but the capital cost was very little, and there was no necessity for a model village for the workers who constructed it.

Election draws near with all sorts of claims and counter-claims; with Jim Farley claiming 43 states for Roosevelt, and John Hamilton claiming he is going to break the solid South for Alfred M. Landon.

Actually there is very little change in the prospects since, last spring, electoral vote tables were printed in one of these articles in an effort to show that, despite the confidence of the Administration, it was not as improbable as most people seemed to think at the time that Roosevelt might be beaten.

—By CARTER FIELD



This noted journalist gives his personal comments and interpretations on current happenings affecting the electrical industry. His background and his location at Washington make his thoughts informative and interesting even though all may not agree with him.

The situation still stands, to use the racetrack expression, as a parlay. To win Governor Landon must carry every one of a group of doubtful states. These are: New York, New Jersey, Pennsylvania, Ohio, Illinois and Michigan. If he carries every one of them he will probably be elected.

In fact, if the writer were just a little more sure about New York State he would predict here and now that Landon would be elected. Because it is the opinion of the writer that Landon *will carry* every one of the other states mentioned in the parlay.

ADDING in New England, which seems set for Landon beyond any question, and Indiana, which will certainly go for him if its neighbors Illinois and Ohio do, the "parlay" gives Landon a total of 228 electoral votes. Adding in Kansas, Nebraska and Wyoming, which are as certain for Landon as anything can be in politics, gives him a total of 247. As it requires 266 to elect, this would leave only nineteen votes for him to pick up to win!

California, to which he is dashing as this is written, would be enough. It has 22 electoral votes.

Iowa, which is a three to two bet for Landon at the moment, added to Minnesota, which is leaning to Landon, would be enough without California. Each has eleven electoral votes.

Failing in all three, a combination of West Virginia, with eight, Delaware, with three, North and South Dakota, with four each, would be enough. At the moment the odds seem to favor Landon in West Virginia despite the efforts of John L. Lewis to vote the coal miners for Roosevelt *en bloc*. Some of the coal miners are beginning to remember what John L. Lewis said, before NRA two years ago, about the threat to their jobs of Roosevelt's water-power dream. They like Lewis, but they don't want the whole country run by water power. They want to keep digging coal.

Incidentally, President Roosevelt was amazed, and frankly said so, several years ago when he first began to run into obstacles in the path of Rex Tugwell's resettlement ideas. Tugwell wanted to move communities still surrounding abandoned coal mines to other sections where living would be easier. Just as he worried folks out in the Dakotas during the drought this year. To his amazement he found that coal miners did not want to go somewhere else. In fact, they did not want to go into any other means of making their living. They liked coal mining and they wanted to keep on digging coal.

Which surprised Roosevelt so much that he told the newspaper men about it. They, in turn, were surprised because they couldn't understand why a man offered any other sort of job should want to keep on being a coal miner. But most of the newspaper men thus surprised wanted to keep on being newspaper men, even when flattering friends told them they could make more money doing something else! Which proves nothing except that most people don't seem to like the idea of regimentation, except as applied to somebody else.

Delaware is so strongly Republican that it gave its electoral vote to Hoover four years ago, although the *Literary Digest* poll (which many at the time did not think reached far enough down to get the people who were really for Roosevelt) indicated it would go for Roosevelt. And the chances in both the Dakotas for Landon are reported excellent as this is written. In fact, the betting odds on North Dakota, despite various polls, favor Landon.

Reverting again to this conviction on the part of so many people that the *Literary Digest* poll does not reach far enough down to get the folks who are for Roosevelt, Delaware may not prove very much. Though it is of interest that part of the Du Pont clan was for Roosevelt four years ago, notwithstanding which the state went for Hoover.

But Pennsylvania should. Here is a state bristling with every element which it was supposed would be for Roosevelt in 1932, and which, it was said, the *Literary Digest* poll was not reaching. But the fact remains that the *Digest* poll showed Pennsylvania for Roosevelt, and it went for Hoover by more than 150,000.

READERS can figure that out for themselves. This writer cannot, and he has made lots of inquiries and given plenty of study to the question. But it is a very interesting point to remember when people say this year that the final *Literary Digest* poll, which shows the country overwhelmingly for Landon, is cockeyed because it does not reach down to the classes of people who are for Roosevelt.

It would seem ordinary logic that if the poll happened to go wrong in overestimating Roosevelt's strength in 1932, it is not conservative, to put it very mildly, to assume that the poll *must* be underestimating Roosevelt's strength in every state this year.

So if the writer were sure that that huge registration in New York didn't spell something he suspects, but hesitates for the sake of the editors of this magazine to charge in its pages, he would predict flatly that Gov. Alf. M. Landon will be the next President.

News OF THE WEEK

T.V.A. Loses Plea to Bar Suit Brought by Nineteen Utilities

Federal Judge overrules motion to dismiss "validity" suit — Provisions set by Congress do not give defendants immunity, court holds — West Tennessee utility gets temporary injunction

Without ruling upon the merits of the case, Judge John J. Gore of the U.S. District Court at Nashville, Tenn., on October 16 denied a motion of T.V.A. attorneys to dismiss the suit challenging the constitutionality of that organization brought by nineteen utility companies in the area.

The motion to dismiss was based upon a provision in the original T.V.A. act establishing the authority's corporate home at Muscle Shoals, Alabama, within the jurisdiction of the District Court at Birmingham. T.V.A. argued that a suit in any other court was out of order. Judge Gore, however, ruled that because of the charges of wrongful and unlawful acts made in the complaint the authority is subject to suit in any court of competent jurisdiction where such acts are being committed.

"I think the averments, if proved, strip the defendants of their official character and constitute them private citizens in that regard," the court said, "and when such conditions exist, they are subject to suit in any court of competent jurisdiction where they are committing said illegal and unconstitutional acts, and where process can be served."

The next step

The next step will be to proceed to trial on the merits of the case unless T.V.A. decides to appeal to a higher court on the jurisdictional issue. This course, however, is not considered likely, as T.V.A. can easily enter an exception to the ruling without prejudicing its rights.

The West Tennessee Power & Light Company of Jackson City, Tenn., on October 14 obtained from the Supreme Court of the District of Columbia a temporary order restraining the P.W.A. from disbursing $663,000 for the construction of a municipal distribution system for T.V.A. power at Jackson City.

A large number of similar cases are now pending in the same court.

Athens, the first Alabama city to contract for T.V.A. power, is now the first municipality in the state to sponsor a county-wide network to take this power to surrounding farm areas, T.V.A. officials have announced. Arrangements have been completed whereby Athens will acquire the authority's rural lines in Limestone County, and in addition, construct about 65 miles of new lines with funds borrowed from the R.E.A. As a result there will be a combined rural system radiating out of Athens and serving 649 farm customers on 135 miles of line.

Transfer of the T.V.A. lines to Athens will be made October 31, and arrangements for construction of new R.E.A. lines will be undertaken immediately. The rural customers are to receive power at the standard T.V.A. resale rates, plus an amortization fee of 1 per cent per kilowatt-hour up to the first 100 kw.-hr. per month, which will be used to retire the cost of the line.

Other municipalities which have extended their lines to serve rural areas with T.V.A. power are Dayton and Pulaski, Tenn., and New Albany, Miss. Holly Springs, Miss., has received an R.E.A. grant for a 170-mile rural network, and the cities of Bolivar, Milan and Somerville, Tenn., are making surveys for radiating rural lines.

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Landon Speaks on Public Utilities

First expression on this subject in entire campaign comes from the Republican candidate in tiff with Ickes

"Our utilities in Kansas in recent years have recognized their obligations to the public and very generally have been making rate adjustments. I believe the best interest of the public is served in bringing about a recognition of this principle nationally," Alfred M. Landon, Republican candidate for President, announced in a prepared statement this week, issued when Secretary Ickes accused the Republican candidate of being a "State Socialist."

"The difference between my plan and the haphazard system of the present national administration is that this administration believes in getting into business and apologizing later," Governor Landon's statement read. "I believe in getting private interests to recognize their obligations to the public, then letting private business alone.

"That is just what I did in Kansas. I got lower rates for the people of Kansas on gas and other utilities, and private business continues to operate.

"I have always been in favor of public ownership as a gun behind the

door in the adjustment of proper and fair utility rates. I have always felt that states that have good municipal ownership laws, consequently good municipal plants, were in the best position to negotiate for lower rates.

"But public ownership on a local and state basis is entirely different from public ownership on a federal basis. In the first case you are using the money of the locality or the state for its own service.

"The federal government is using the money of all the states for the benefit of one."

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Michigan Commission Fights Federal Plan

Calling in effect for "Michigan power for Michiganders," the Public Utility Commission of that state has registered a sharp protest against the Federal Power Commission's plan to divide the United States into regional districts for rate-making purposes.

A letter to the federal agency from the state commission declared that while the federal plan was drawn to "assure an abundant supply of electric energy throughout the United States with the greatest possible economy and with regard to the proper utilization and conservation of natural resources," it would raise monthly bills of Michigan power users.

The letter claimed that Michigan enjoys rates below those in neighboring states and under the Federal Commission's plan would be subject to rates in effect in those states.

Public Ownership League Meets Before Springfield Election

Ross discusses Northwest's future power needs — Seven speakers advance theory necessity for dividend payments is fatal disadvantage

***Bulletin*—Despite the fact that the Public Ownership League held its annual convention in Springfield last week, 29,000 citizens this week voted three to one against acquisition of Central Illinois Light Company, Commonwealth & Southern affiliate. Citizens also rejected flotation of $8,500,000 bond issue.**

Special to ELECTRICAL WORLD

"It is certain that the Northwest will be looking for further sources of power before ten years go by." This pronouncement was made by J. D. Ross, superintendent Seattle City Light and member of S.E.C., at the 21st annual convention of the Public Ownership League of America held last week at Springfield, Ill.

Just previously he had said that "the world's greatest hydro-electric power center today is in the Pacific Northwest. Washington State," he went on, "contains one-sixth of the water power of the nation. Oregon makes a good second and Idaho and Montana are also the possessors of a vast heritage in hydro power.

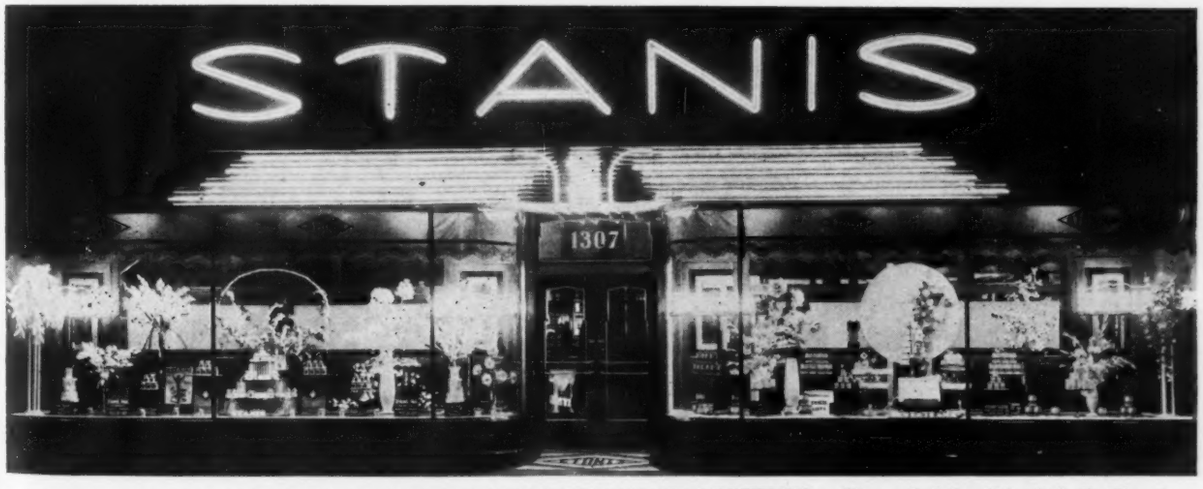
"The total capacity of existing plants in these three states is 1,482,118 kw. The three great plants—Skagit, Coulee and Bonneville—expect to add a combined total of 1,875,000 kw. of firm power. Add this to the present capacity of 1,485,000 kw. and we have 3,360,000 kw. to meet a demand 5½ years from now. This would only leave an excess of 390,000 kw. for the three states at that time.

"Perhaps the private power concerns will develop more power, but even if they do, it is easily seen that in ten years there will be a cry for more power in the Northwest."

At least seven of the speakers on the program—public property commissioner, engineer, economist, statesman, educator—from as distant and varied regions as New York and California, put forth the argument that the necessity of private utilities to pay dividends will force them out of the field, leaving power as a public monopoly.

"The people," said E. F. Scattergood, chief electrical engineer and general manager of the Los Angeles Bureau of Power and Light, in a paper read in his absence by Ralph Criswell of Los Angeles, are entitled to the benefits of power "without the intervention of any agency which is chiefly interested in adding enough to the necessary charges to provide dividends."

Congressman John E. Rankin of



FIRST CHICAGO STORE WINDOWS WITH MERCURY-VAPOR LIGHTING—Clear, bright "daylight" illumination which gives the windows a striking appearance is attained by using the new mercury-vapor and standard incandescent lamps together. This combination causes the goods in the window to stand out with striking effect. Each window contains nine 150-watt Mazda lamps and two 450-watt mercury vapor, producing an intensity of 120 foot-candles. Picture courtesy of Commonwealth Edison Company

Mississippi, co-author with Senator Norris of the Tennessee Valley Authority, declared that cheap power for the farm "is the greatest home-building program the land has ever seen," but added, "it can't be done by holding companies. In so far as I can prevent it," he continued, "no private company will ever build a dam on a navigable stream. I propose for the government to do it, and to carry power to the gates of the cities and municipalities, from where there should be local distribution."

Dr. John Bauer, director American Public Utilities Bureau, New York City, declared that "the generation of power is a natural monopoly," and added that there is "inherent conflict in doing a public job with private organization for profit.

"Whether by regulating private business, or through direct governmental undertaking, the federal government will have to assume the responsibility of assuring stabilized employment, of stabilizing the flow of purchasing power and of preventing monopoly abuses," he declared.

Mr. Spaulding, whose address was confined to plans for Springfield's consolidation, in an interview, said that "consolidation is not practical for every city. Neither is municipal ownership practical for every community. It cannot be a success unless the people want it and stand behind it."

William I. Nichols, director division of electrical development for the T.V.A., speaking in the place of the authority's commissioner, David Lilienthal, who could not be present, emphasized the significance of the T.V.A. "as a proving grounds" rather than as an end in itself.

Senator Rush D. Holt of West Virginia, who was to have spoken on "The National Utility Issue," was also absent.

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Shreveport to Install More Trolley Coaches

The urban transportation problem in Shreveport, La., is being solved by changing the transit system over to trolley coaches. The city already has twenty 30-passenger vehicles in service and will soon place an additional nine of the larger 40-passenger coaches on heavy traffic routes. All the equipment has been built by the J. G. Brill Company and is equipped with General Electric motors and control.

Supreme Court Soon to Hear Duke Power Case Against P.W.A.

Loans to competing power agencies will have their first Supreme Court test solely on the issues raised in Greenwood County

The U.S. Supreme Court this week denied the request of the Alabama Power Company and the Texas Utilities Company that cases directed against P.W.A. loans and grants to nine cities within their territories be joined to the pending litigation between the Duke Power Company and P.W.A. and Greenwood County, South Carolina, which are shortly to be reviewed.

Involved in the cases are the municipalities of Plainview, Tex., and Sheffield, Tuscumbia, Decatur, Russellville, Guntersville and Hartselle, Ala. Actions were originally brought in the Supreme Court of the District of Columbia, which upheld the right of P.W.A. to make allotments for power-plant construction in these communities. An appeal taken by the companies to the next higher court is still pending, but the effort to join the cases with the Duke suit, already before the highest tribunal, was made because of the similarity of the issues.

The denial means simply that the Supreme Court wishes the Alabama Power Company and Texas Utilities Company cases to proceed in regular order through the next lower court. Furthermore, Secretary Ickes, who is being sued, had urged regular procedure on the plea that certain issues were involved which properly should be passed upon by the lower court.

As the matter now stands, the Supreme Court will hear the Duke Power Company versus Greenwood County and P.W.A. on or about November 9. The Alabama Power Company and Texas Utilities Company cases will come up next before the district Court of Appeals.

P.W.A. Releases Data of Three-Year Survey

"The survey reveals that in certain types of P.W.A. construction the ratio of indirect to direct labor is greater than had hitherto been indicated. Thus an analysis of six completed power and light plants shows that labor and material costs on the projects totaled $461,628," states a press release this week issued by the Federal Emergency Administration of Public Works, which discusses a survey by Herman B. Byer of the Bureau of Labor Statistics.

"Thirteen and two-tenths per cent of this sum was paid to site labor and 86.7 was spent for materials. Labor at the site accounted for 18.4 per cent of the total man-hours of work, while labor in mines, factories and transportation companies accounted for 81.6 per cent. Thus for every man-hour at the site 4.4 man-hours employment was required in indirect labor."

The survey is the result of three years of study of the P.W.A. program made by Mr. Byer and other statisticians of the Department of Labor. Their study, which is nearing completion, is expected to determine definitely for the first time the ratio between direct and indirect employment in public works or the relationship between work created at building sites and that generated in producing, fashioning and transporting materials.

A selected group of industries receiving P.W.A. orders showed increases in employment ranging from 14.2 to 225.4% during the three-year period, according to the survey.

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Rural Conference Held in Arkansas

Arkansas Utilities Commission last week called a conference of officials of the larger Arkansas utilities to discuss the new rural electrification program designed to electrify a large portion of the 200,000 Arkansas farms now without service.

Officials of the Arkansas Power & Light Company, Southwestern Gas & Electric Company, Oklahoma Gas & Electric Company, Arkansas-Missouri Power Company and the Arkansas Utilities Company were invited, since these five companies furnish more than

90 per cent of the electric power used in the state.

Representatives from these five major companies pledged co-operation in the proposed plan and agreed that the commission had arrived at a logical decision in favoring a single non-profit corporation to carry on the rural electrification program.

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Reconstruction Work at Gorgas Plants

Alabama Power Company is proceeding with considerable reconstruction work at its two Gorgas steam plants, made necessary by the recent decision of U.S. engineers to raise lock 12 on the Warrior River. The normal backwater lake at Gorgas will be raised from 245 to 257 feet above sea level.

C. C. Davis, formerly connected with the company but more recently a government engineer, has been placed in charge of the work. The new water level, he said, presents problems not contemplated when the plants were designed. Land in the vicinity of the plants will be permanently flooded, roads and bridges affected. Cooling water arrangements must be modified and other mechanical changes will have to be made. The biggest jobs are rebuilding the structures at the head of the intake canal for No. 2 plant and raising the heights of the canal bank. This outside work must be completed before the winter floods, but inside work may be completed by June 30, 1937.

Rural Load Building Discussed at Skytop

From twelve North Atlantic states utility men, manufacturers, government agency representatives and agricultural college principals gathered for three days last week at Skytop Lodge, Pennsylvania, to hear approximately 50 speakers discuss the problems of rural electrification after the line is up, under the sponsorship of the American Society of Agricultural Engineers.

"The Electrification of American Agriculture," an address by Commercial Manager H. E. Dexter of Central Hudson Gas & Electric, gained most favorable comment, particularly the discussion of the low-use rural customer and ways to increase his usage of electric service.

John M. Carmody, Rural Electrification, spoke of R.E.A.'s determination to speed the electrification of America's farm houses, and E. A. White of the Committee on the Relation of Electricity to Agriculture called attention to increased farm incomes, the rural sales records of mail order houses and the developing uses of electric service on the farm.

Electric brooders, he said, are a major load builder, profitable to farmer and utility alike. Pig brooding, irrigation, feed grinding, frost protection devices, concentrated laying houses, milk pasteurization, milk refrigeration, greenhouse lighting, ventilation and heating were among the uses cited.

Joseph S. Webb, Philadelphia Electric, reminded hearers of the revenue possibilities of small commercial establishments, such as roadside stands, as a means of bolstering revenue. George W. Kable of T.V.A. emphasized the importance of better fitting electrical equipment to the needs of the farmer, to assist him in profitable farm management. T.V.A., the speaker said, is experimenting with new applications of hay drying, cooling and curing boxes and community freezing lockers.

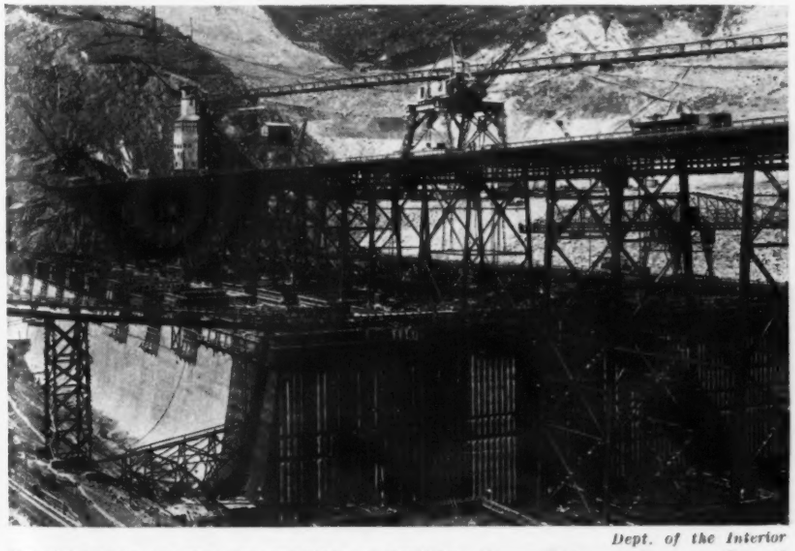
Load-building methods in farm homes adjacent to rural lines, but not taking service, were outlined by Edward J. Roche of Potomac Edison. Customers are asked to pay a monthly minimum of $1.25, but no down payment on equipment or wiring, three to five years to pay, 5 per cent carrying charge. Numerous customers, strangely enough, said they were afraid to use electric service because they thought it "dangerous."

A brand new all-color rural film was exhibited by Rochester Gas & Electric Corporation which will be used to show electricity performing in rural service for the dairy, poultry farm, soil pasteurization, soil heating, irrigation and other uses.

Motors were pictured in a variety of farm uses, such as for water pumping in various capacities, band saws, drill presses, feed grinding, hay choppers, fruit washing, drying, sorting and brushing.

Borlase Matthews, World Power Conference visitor to these shores, was among those who spoke, and other speakers discussed farm wiring, rural home lighting problems, lightning protection and phenomena, 4-H Electric Clubs, and other subjects pertaining to rural electrification problems after the line is constructed.

Penn State's Ralph Upshur Blasingame is president of A.S.C.E. and North Atlantic Section chairman is George A. Rietz, in charge of rural electrification section, General Electric Company.



Dept. of the Interior

UP-STREAM FACE OF GRAND COULEE—Now taking shape at Grand Coulee are the million-cubic-yard concrete blocks which comprise the up-stream dam face. Here is the first block

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Tax on Air Units Energy

Ruling has been made by the U. S. Treasury Department that electric utilities must pay a 3 per cent tax on power which they sell to office buildings, apartment houses and similar institutions for use in running air-conditioning systems.

POWER SALES ENGINEERS AT FORT WORTH

Front Row—K. K. Kreamer, Houston Lighting & Power; C. M. Bliven, Southern California Edison; D. C. McKee, Empire District Electric; O. A. Jennings, Oklahoma Gas & Electric; O. W. Jones, Central Power & Light; B. L. Moore, Humble Oil & Refinery; J. E. Elliott, Southwestern Gas & Electric; W. S. Baugh, Kansas Gas & Electric; W. H. Hodge, Public Utility Service Corporation; Ford Bates, Nebraska Power; W. C. Dreyer, Westinghouse Electric & Manufacturing; C. M. Robinson, Public Service Company of Oklahoma; C. T. Hough, Kansas Electric Power.

Second Row—G. H. Weckel, Kansas Gas & Electric; H. C. Lockherd, Stanolind Pipeline Company; P. M. Cordell, Texas Electric Service; H. E. Roberts, Empire District Electric; Langstone Ashford, Southwestern Gas & Electric; Kenneth Johnson, Arkansas Power & Light; Frank R. Innes, ELECTRICAL WORLD; P. J. Harmon, Texas Electric Service; W. H. Stueve, Oklahoma Gas & Electric; B. E. Lowe, Southwestern Light & Power; R. A. Graves, Kansas City Power & Light; R. E. Patrick, Kansas Gas & Electric; K. M. Hardy, Oklahoma Power & Water; R. D. Hayes, Middle West Service; J. M. Neighbors, Oklahoma Power & Water; E. A. Armstrong, Public Service Company of Northern Illinois; F. V. Armistead, Union Electric Light & Power.

Back Row—C. H. Purdy, Consolidated Power; J. E. Barfield, St. Joseph Railway, Heat & Power; D. G. Iliff, Kansas Gas & Electric; E. L. Kavanaugh, Detroit Edison; C. R. Bayliss, Gulf Oil Corporation; E. L. Robinson, Gulf States Utilities Company; L. F. Riegal, Gulf States Utilities; W. C. Carter, Westinghouse.

Power Salesmen Ask National Advertising

By its own successful use of advertising as a tool for selling central station energy to the oil industry the Petroleum Electric Power Club at its eighth annual conference in Fort Worth, Texas, last week, felt well qualified to recommend national advertising of purchased power. This it did, or, rather, instructed its president to do, in a letter to C. W. Kellogg, president of the Edison Electric Institute. The motion was made by O. A. Jennings, Oklahoma Gas & Electric Company, and was carried.

An excellent paper on power sales by W. H. Hodge, Public Utility Service Corporation, pointed out that the utilities must retain and proportionately increase their power loads so that they may continue to be enabled to serve other classes of business at reasonable rates. A report by C. H. Purdy, Consumers Power Company, on the work of the E.E.I. power and industrial heating sales subcommittee in regard to Diesel engine competition said: This group is endeavoring to bring out and make available to power salesmen the complete facts of publicized Diesel installations.

Increased use of purchased power in oil refineries was the impression to be taken from the paper "Uses of Electric Power in the Refining of Petroleum," by D. R. Johnson, Continental Oil Company. This increased use of purchased electricity, said Mr. Johnson, will depend on the continued reduction of power rates, on improvement in electrical equipments and on co-operation between the engineers of the refineries, of the electrical manufacturers and of the utilities.

Co-operative advertising was discussed by W. H. Stueve, Oklahoma Gas & Electric Company; C. M. Robinson, Public Service Company of Oklahoma, directed the discussion on pipe line pumping; J. E. Elliott, Southwestern Gas & Electric Company, on oil well pumping; G. H. Weckel, Kansas Gas & Electric Company, on oil well drilling; and E. L. Robinson, Gulf States Utilities Company, on oil refineries.

New officers elected were: President, F. M. Austin; vice-president, C. N. Robinson; secretary-treasurer, E. L. Robinson; directors, F. M. Austin, C. T. Hough, O. W. Jones, C. N. Robinson, J. E. Barfield and K. C. Johnson.

Meetings

American Institute of Electrical Engineers—Southwest District, Dallas, Tex., October 26–28. H. H. Henline, national secretary, 33 West 39th Street, New York.

American Institute of Physics—Anniversary meeting, New York, N. Y., October 29–31. Henry A. Barton, director, 175 Fifth Avenue, New York, N. Y.

National Association of Railroad and Utilities Commissioners — Annual convention, Atlantic City, N. J., November 10–13. Clyde S. Bailey, secretary, 806–808 Earle Building, Washington, D. C.

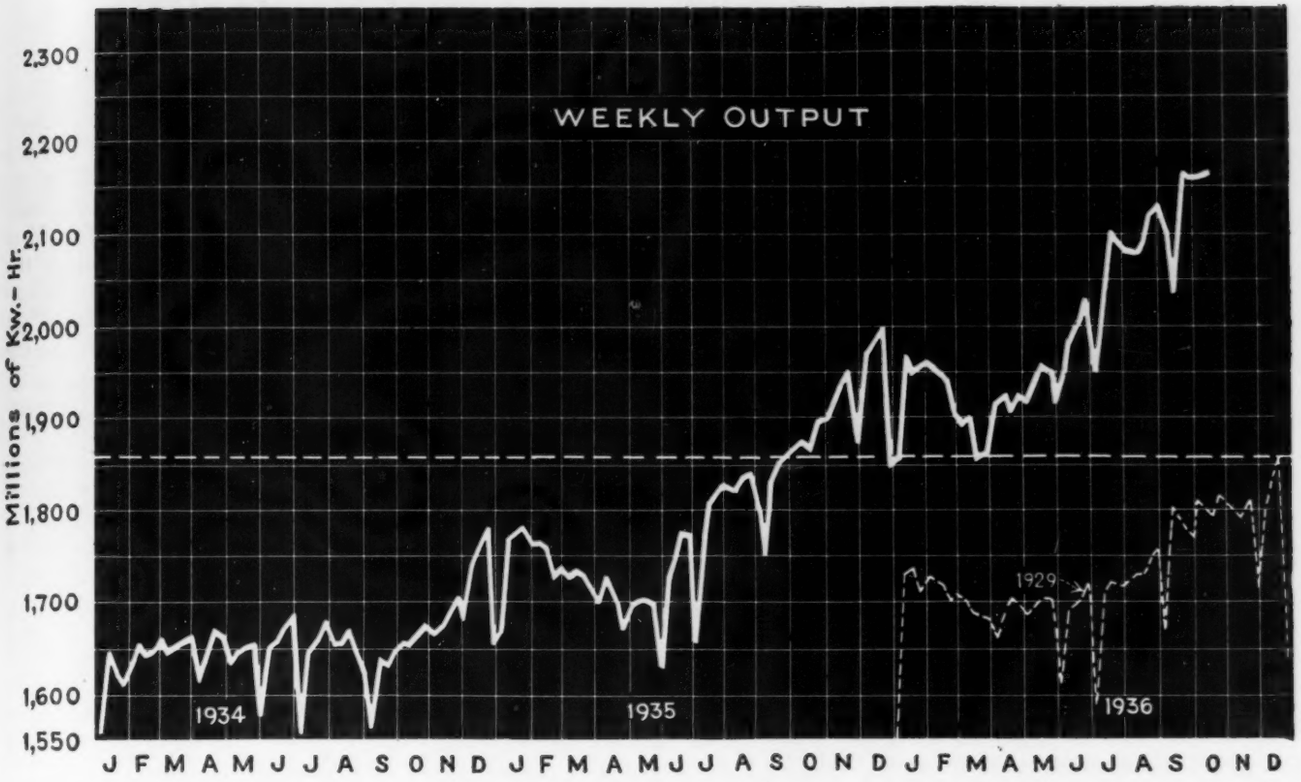
American Society of Mechanical Engineers—Annual meeting, New York, N. Y., November 30–December 4, C. E. Davies, national secretary, 29 West 39th Street, New York, N. Y.

National Exposition of Power and Mechanical Engineering — Grand Central Palace, New York, N. Y., November 30–December 4.

A.I.P. to Hold Joint Meeting

A joint meeting of the member societies of the American Institute of Physics will be held in New York, N. Y., October 29-31, at the time of the fifth anniversary of that organization.

Output 16.5 per Cent Above Last Year



Continuing more than 20 per cent higher than in 1929, the production of electrical energy in central stations during the week ended October 17 amounted to 2,170,127,000 kw.-hr., according to the Edison Electric Institute. The increase of 16.5 per cent over the like week of 1935 indicates that the excess recorded in the past several months is being maintained.

For the fifth consecutive week the output has been virtually constant at the highest level ever attained.

Heightened activity in the Central industrial area seems to be indicated by the rise in output to 19.2 per cent over 1935. The South was second, with 18.5 per cent, after ranging around 23 per cent for six weeks. Gains in the Middle Atlantic and the two Western regions were about 15 per cent.

Weekly Output, Millions of Kw.-Hr.

1936		1935		1934	
Oct.	17..2,170	Oct.	19..1,863	Oct.	20..1,668
Oct.	10..2,168	Oct.	12..1,867	Oct.	13 1,657
Oct.	3..2,169	Oct.	5..1,863	Oct.	6..1,659
Sept.	26..2,157	Sept.	28..1,857	Sept.	29..1,649
Sept.	19..2,171	Sept.	21..1,852	Sept.	22..1,631
Sept.	12..2,029	Sept.	14..1,828	Sept.	15..1,634

Per Cent Change from Previous Year

Region	Week ended Oct. 17	Oct. 10	Oct. 3
New England	+ 9.8	+10.3	+12.8
Middle Atlantic	+15.0	+15.5	+14.8
Central Industrial	+19.2	+17.7	+18.1
West Central	+ 8.8	+11.1	+12.6
Southern States	+18.5	+22.9	+21.5
Rocky Mountain	+14.5	+16.9	+16.0
Pacific	+15.3	+11.8	+12.0
United States	+16.5	+16.1	+16.4

Engineers to Study Transmission Pool

Engineers of the Commonwealth & Southern Corporation, the Tennessee Valley Authority and the Federal Power Commission are currently engaged in a survey of power transmission systems in the T.V.A. area, it was learned this week. Physical data relating to the location, capacity and length of present transmission lines will be gathered, with supplementary data on the communities and their power requirements in the area. Sources of power and distribution systems will not be embraced in this survey, it was reported.

Developments of this nature were anticipated a month ago, when President Roosevelt announced a conference to work out a constructive plan for the proper development of the nation's natural resources.

Well-informed utility sources state there is no thought of halting the present series of court actions to test the constitutionality of the entire T.V.A. operation. Within the past ten days T.V.A. lost its appeal to Federal Judge John J. Gore to dismiss the suit of nineteen utility companies on technical grounds involving jurisdiction.

From the same sources it was learned that the engineering committee will simply continue its studies, entirely apart from legal steps under way, and a report of the transmission system survey will be tendered to President Roosevelt.

To Add 60,000 Kw.

Louisville Gas & Electric Company and San Diego Consolidated Gas & Electric Company have authorized the installation of increased generating capacity of 25,000 kw. and 35,000 kw., respectively, it is stated in a letter to the shareholders of the Standard Gas & Electric Company. The rapid growth of load practically throughout the entire Standard Gas & Electric Company system has made it necessary for most of the operating utility companies to give serious attention to the increasing of generating capacity. Active studies looking toward such increases are now being undertaken. It is expected that during the next few months other Standard companies will also authorize additional facilities.

Utility Stocks Move Downward

Following the general trend, electric light and power stock prices drifted to lower levels this week. "Electrical World" index, 38.2; last week, 40.2

Jersey Power Plan Agreement Reached

Associated Gas & Electric interests and the debenture holders' protective committee of National Public Service Corporation have reached an agreement on the modified plan of reorganization of the bankrupt former Insull utility. The committee has addressed a letter to all holders of debentures informing them that as a result of its discussions with Associated interests it has been able to obtain a third optional arrangement whereby holders may receive $350 in cash for each $1,000 debenture on October 28.

The committee has agreed with Associated interests that if they purchase on October 28 all certificates of deposit which elect the cash option, it will thereupon approve and recommend the plan to all holders of certificates of deposit who elect not to sell at this time.

As a result of the agreement, the sale at public auction of the Jersey Central Power & Light Company majority stock which secures the National Public Service debentures has been forestalled and is expected to be canceled at the court hearing on the reorganization plan on October 28.

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Says Reduced Rates Doom Private Plants

"After the emergency taxes have been reduced and the volume of business has been increased," Floyd Carlisle, chairman of the board Consolidated Edison Company, said this week, "rates, I hope, will have been reduced so as to make the operation of private plants impracticable."

Mr. Carlisle was appearing before the Public Service Commission at a hearing to develop company policy on acquisition of isolated plants. One Park Avenue Company's plant was acquired at a cost of $149,000, Mr. Carlisle said, and gross from this customer now approximates $72,000 per year.

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New Utility Issues

During the past week the Cumberland County Power & Light made an offering of first mortgage bonds, 3½ per cent series, due 1966, a piece of financing involving a total of $9,500,000. The bonds were priced at 103¼ and accrued interest. At the same time the utility made a preemptive offering of 10,000 shares of 5½ per cent cumulative preferred stock to holders of preferred and common stocks at $103 a share on the basis of one share for every 8.7194 shares held on October 17.

Lake Superior District Power Company issued first mortgage bonds, series A, to the amount of $5,600,000 at 101¾ per cent and accrued interest.

First and refunding mortgage 3½ per cent bonds, totaling $7,000,000, were recently offered by the Connecticut Light & Power Company at 105 per cent and accrued interest. At the same time the company made an offering of twenty-year 3½ per cent debentures, priced at 102 per cent and accrued interest, totaling $7,500,000.

Groesbeck Appraises Utility Outlook

Stockholders greeted with applause the remarks of C. E. Groesbeck, chairman of the board, Electric Bond & Share Company, as he appraised the current utility outlook at the annual meeting held last week in New York City. The status of litigation to test the constitutionality of the Holding Company Act, financial reports of the companies, the relation of electric service bills to the family budget, the increasing tax burden and taxpayer-subsidized threats of competition were concisely reviewed by Mr. Groesbeck. A dozen large charts were utilized to picture the various situations to attending stockholders. Mr. Groesbeck said:

At the present time the cost of living is 43 per cent *above* the level of 1913. The price of residential electricity, on the other hand, is more than 44 per cent *below* the level of 1913. The chart shows that the trend of the price of residential electricity has been steadily downward over a period of 45 years, with only one brief interruption.

Savings to customers of National Power & Light subsidiaries since 1929 were said to amount to more than $44,000,000, a point of unusual interest due to the fact that territory served by companies in the Bond & Share group consists mostly of medium-sized and small towns. Mr. Groesbeck went on to say:

The tax burden on the subsidiaries of the four domestic groups for the twelve months ended August aggregated more than $40,000,000 and was $4,500,000, or 13 per cent, higher than for the preceding twelve months.

There will be additional taxes for 1937 under the Social Security Act and material increases in accounting costs due to a new classification of accounts prescribed by the Federal Power Commission.

Added to these impositions is the serious and devastating competition of government-financed plants. Management cannot exercise control over these mounting items of expense and they constitute a definite factor in retarding rate reductions.

The consumer ratepayer is taxed to provide money with which to build unnecessary and duplicate plants. The investor is taxed to provide money with which to destroy the very investment which provides him with income to pay taxes. The companies are taxed to provide money for the building of plants to destroy their own business.

No business or industry can survive the combination of both regulation and competition at the hands of the federal government. Recently conferences were initiated at Washington to consider a course of action designed to ameliorate the present threatening competitive situation. It is to be hoped and earnestly hoped, that some satisfactory solution of this problem, serious from every standpoint, may be evolved.

Manufacturing AND MARKETS

Increased Demand for Copper Products

"There has been a marked increase in the consumption of products made from copper and its alloys during the first nine months of this year, and the outlook for the fourth quarter is most encouraging," F. S. Chase, president of the Copper and Brass Research Association, announced at the recent annual meeting of members. "Present indications," he said, "point to the tonnage for 1937 exceeding that of the present year by most consuming industries." Mr. Chase added:

> The largest tonnage of copper is, of course, used in the electrical field. The mileage of rural lines being built this year will more than double that of 1935. Not only is this expansion consuming large amounts of copper for transmission lines, but the sale of all electrical appliances such as vacuum cleaners, electric irons and other labor-saving devices exceeds that of any year since the depression was first felt . . .
>
> The long-awaited and hoped-for building boom is just getting in its stride . . . The outlook for considerable increase in the volume of building in 1937 over 1936 is bright, with the result that the consumption of all better building materials will show considerable increase . . .

The following officers were elected: President, F. S. Chase, Chase Brass & Copper Company, Inc.; vice-presidents, John A. Coe, American Brass Company; C. D. Dallas, Revere Copper & Brass, Inc.; Wylie Brown, Phelps Dodge Copper Products Corporation; treasurer, C. D. Dallas, Revere Copper & Brass, Inc.; secretary, Bertram B. Caddle.

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Air Unit Installations Set Record in Chicago

Air-conditioning installations in Chicago for the first nine months of this year set a new high mark, according to a report made last week by the Commonwealth Edison Company. Air conditioning equipment installed or contracted for in that period totaled 402 units with a combined capacity of 7,188 hp. This is a 39 per cent increase over the 290 reported for the corresponding period of 1935, which had a capacity of 5,253 hp. Chicago continues to lead all other American cities in air conditioning. The number of installations now totals 1,336 with a combined capacity of 56,120 horsepower.

Fifteen new plants were contracted for in September, 1936, with a capacity of 297 hp. The significant feature of the nine months' statistics, the Commonwealth Edison report stated, is the rapid increase in residential, private office and general office installations.

Rails and Utilities Can Aid Employment

"I venture to say," Myron C. Taylor, chairman of the board, United States Steel Corporation, told a group of Birmingham industrialists last week, "that if the railroads of the country alone were called upon to operate in a fully normal way, necessitating that they proceed with their usual plans for improvement and development, this would provide a great volume of business and furnish much employment.

"The same may be said of the construction industry, the public utility industry and related enterprises," he added.

Occasion was the announcement by

CROSSING, CURVE, BRIDGE—The two municipalities of Akron and Cuyahoga Falls jointly bought and recently opened this unique lighting system. The bridge approach is lighted by 10,000-lumen "sodiums," high-visibility, incandescent luminaires are used for the roadway and two 6,000-lumen incandescents illuminate a dangerous area; all equipment by General Electric

SAVED

President William A. Irvin of the steel company's Birmingham subsidiary's plan to begin a $29,000,000 expansion program. The new plants, Mr. Irvin said, will add 2,500 men to the 17,000 now employed by the Birmingham subsidiary, and the program, which includes a new tinplate mill, will begin immediately.

Two continuous cold rolling mills for light gage plate, a new blooming mill and two batteries of coke ovens are included in the extensive additions.

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Kelvinator Enters Laundry Field

Distribution of the new Kelvinator washing machines and ironers will be started the first of the new year, according to announcement made in Detroit by V. J. McIntyre, sales manager of Kelvinator's laundry equipment division. Plans are now complete for distribution, Mr. McIntyre stated.

"Kelvinator's manufacturing facilities in Detroit, even with its new additions, are taxed to the utmost to meet the demand for refrigeration and air conditioning equipment," said Mr. McIntyre, "and when it was decided to enter the washing machine and ironer field, it was deemed advisable to provide manufacturing facilities in another factory. Investigation finally narrowed the choice of manufacturing facilities to Alliance, Ohio, and this factory is now ready to commence production."

Mr. McIntyre stated that several new and exclusive developments in the design of washing machines would be incorporated in the Kelvinator washers. "The addition of this line," he said, "will serve to smooth out the sales peaks which are characteristic in the merchandising of electric refrigeration, and will provide Kelvinator dealers and distributors with a well-rounded line of household equipment . . ."

New York Metal Prices

	Oct. 14, 1936 Cents per Pound	Oct. 21, 1936 Cents per Pound
Copper electrolytic	9.75*	9.75*
Lead, Am. S. & R. price	4.60	4.60
Antimony	12.00	12.00
Nickel ingot	35.00	35.00
Zinc spot	5.225	5.225
Tin Straits	44.62	44.55
Aluminum, 99 per cent.	19—21	19—21

* Delivered Connecticut Valley.

Field Reports on Business

Business activity is increasingly on the up-grade, with optimism running high. Myron C. Taylor, chairman of the board of the U. S. Steel Corporation, stated that the forces of depression have been routed; that the nation's unsatisfied needs are vast. He said: "In consequence of the depression there has been created a tremendous need for capital goods, which will soon translate itself into absolute necessity, so that deficiencies may be filled."

NEW ENGLAND

Sales of electrical equipment in this district show a steady volume and continue to feature encouraging interest in orders for small motors and switch and control apparatus. A prominent representative in close touch with the industrial situation in this district reports that a recent survey of available factory floor space revealed that recent factory expansion had absorbed most of the desirable area and that the 1928 high level of floor space occupancy was rapidly being reached. This explains the activity in this district in industrial equipment sales and accounts for a large bulk of orders for factory lighting equipment and wiring supplies.

Orders for pole line materials for suburban service have been received in good volume and deliveries of poles, crossarms and line hardware for rural lines are being rushed while open weather lasts. Interest in industrial electric trucks is reported in recent sales of two of these in this district. Inquiries for electric arc welders are active; street lighting is receiving attention in western Massachusetts, where the city of Chicopee is considering the installation of sodium-vapor lamps on about 5 miles of streets.

Merchandising sales are gaining, with refrigeration unit absorption in southern Vermont reaching nearly 2,500 for this year to date and 605 electric range sales. Electric laundering appliances are selling well. Portable electric lamps and small electric kitchen appliance sales are picking up.

P.W.A. funds amounting to $26,650 have been applied for in connection with the proposed construction of a power plant for a Rhode Island state home and school. A moving picture theater has been planned for Winchester, Mass., and will include air conditioning and special lighting effects at a cost of $125,000. In Connecticut the Hartford Electric Light Company is to erect a new substation building on Pearl Street at an estimated cost of $37,000.

CHICAGO

The quickening tempo of business and industry was reflected last week in the barometer of activity in many lines. Particularly encouraging was the evidence that the railroad industry is returning to the ranks of the prosperous. More and more orders are being placed for locomotives, cars and rails as freight and passenger traffic continues to mount. Activity in steel continued at the level of around 75 per cent of capacity. Electric power output remained near the peak. Wholesale and retail trade maintained a steady tone, with the volume substantially ahead of last year.

Central-station purchases are steadily increasing. Air-conditioning installation in Chicago during the first nine months increased 39 per cent over the same period last year, bringing the total number to 1,336 with a combined capacity of 56,120 hp. One manufacturer of small appliances reports sales better than 25 per cent above 1935. Radio sales are booming and lighting equipment manufacturers report steady demand for industrial and commercial units. The Better Light-Better Sight Movement is showing excellent results for I.E.S. lamps.

NEW YORK

Fresh strength and activity were displayed in the world copper markets this week, the metal selling well over 10 cents per pound in Europe. It was reported that domestic sales on the preceding day had been 3,898 tons. The range of prices in Europe revealed that foreign prices are the highest since April, 1931. The domestic price of 9 3/4 cents per pound is being scrutinized for a possible advance.

Automotive activity is far ahead of its 1930 high and electric output of its 1929 high. Wholesalers are reported deluged with orders for holiday merchandise. Department store trade in the metropolitan area during the first half of October showed an increase of 8.4 per cent over the corresponding period last year, according to figures issued this week by the Federal Reserve Bank of New York.

PACIFIC COAST

Building permits to date show a value increase over last year of 50 per cent, 25 per cent for the Bay region and 25 per cent for the Los Angeles area. Federal mediators apparently have the threatened shipping strike situation in hand, though seamen are obstinately insisting on a strike vote. Nevertheless, business has markedly slumped during the past week due to political and labor uncertainty, with many fairly large jobs pigeonholed for the present.

Heavy anticipatory buying has also cut into present demands of construction material. Appliances, however, are selling well, with refrigerators more than topping the total sales of all other major appliances except radios, which are responding splendidly to seasonal urge.

Lighting material sales are excellent, with floodlights moving up to a 1,500-watt standard. Several new 60-kw. football fields are reported, together with many rural high school reinstallations averaging a load increase of 50 per cent. The Bay Bridge has contracted for 412 kw. for lighting and power at an annual revenue of $18,000.

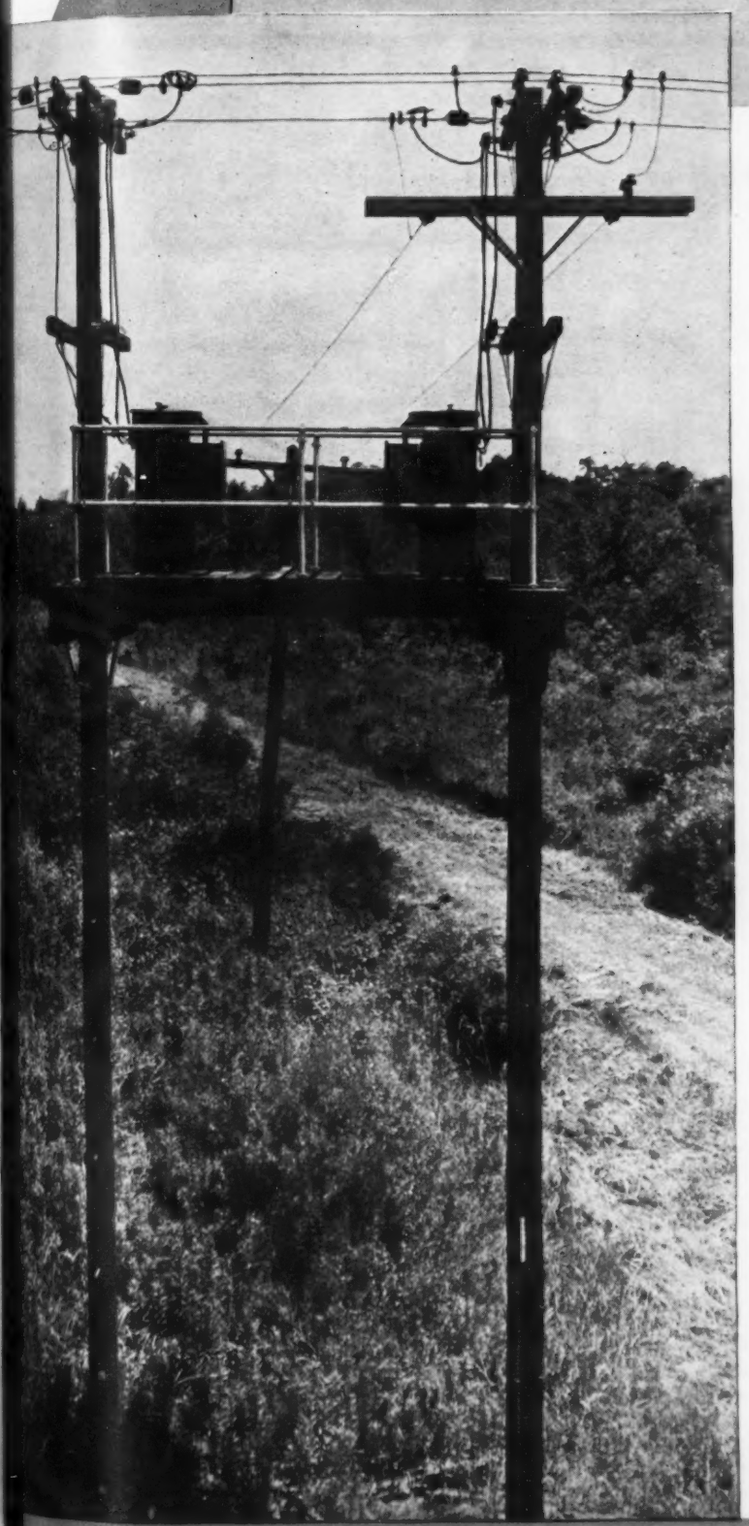
Schools predominate in construction reports, including $2,000,000 for Los Angeles junior colleges and high schools, $500,000 for a San Francisco junior college and as much more for partial conversion of an agricultural college to a general curriculum. Movie theatres averaging $200,000 each are again a construction feature in various interior cities and Columbia Broadcasting is building a Los Angeles auditorium for its national feature hookups.

SAVED

$1600 in Capital Investment

IMPROVED SERVICE

by Maintaining Proper Voltage Levels



Two G-E 2400-volt, 24-kva, single-phase, 60-cycle, branch-feeder induction regulators. These units are suitable for crossarm mounting

WHEN it became desirable to raise the voltage levels on a 10-mile branch feeder, the Gulf States Utilities Company, Beaumont, Texas, saved $1600 in capital investment by the installation of two G-E branch-feeder induction regulators four miles out on the line. The feeder was already regulated from the station, but load conditions were such that in order to maintain high-quality service, additional regulation was needed. To accomplish their purpose by rebuilding the line would have cost $4000 for copper alone, while the branch-feeder induction regulators were installed for $2400. Proper voltage levels were maintained, and service was improved.

Take Advantage of Regulation's Big Three

This example typifies the results being obtained by operating companies all over the country after installing G-E regulating equipment. The details of each case vary, but the pattern remains the same. Regulation with G-E equipment provides one or more of the following advantages:

A profitable investment
A saving in capital investment
Improved service

A Complete Line—for Profitable Regulation

The complete line of G-E regulating equipment will enable you to regulate voltage economically on any part of your system, for any load density. For complete information, write for GES-1142A. Address the nearest G-E office, or General Electric, Dept. 6A-201, Schenectady, N.Y.

850-129

GENERAL ELECTRIC

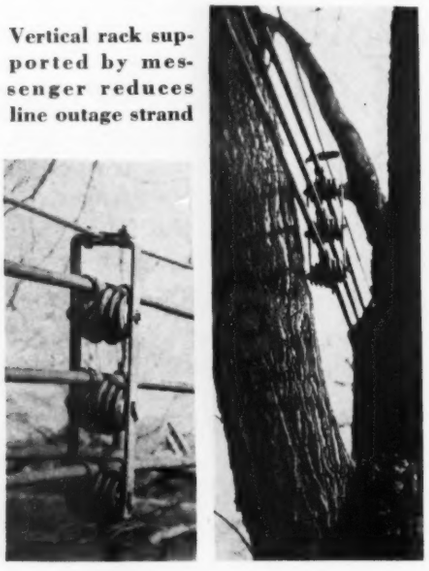
Field OPERATING PRACTICES

New ideas and practices in the operation of well-designed, constructed and maintained plants and systems

Vertical Racks Solve Tree Wire Problem

By P. M. GENTZEL & M. A. GILES
Ohio Public Service Company
Elyria, Ohio

A unique method of supporting tree wire on vertical racks suspended from messenger strand was the outgrowth of a problem that recently faced the Elyria division of the Ohio Public Service Company when it found that a 6,900-volt open-wire line along a rural road was being continually taken out of service by limbs breaking off during every windstorm. Right-of-way off the highway could not be obtained and it was impractical to go over the trees, which were 75 ft. in height.



Vertical rack supported by messenger reduces line outage strand

Racks as illustrated were constructed locally from flat crossarm braces and heavy spool insulators giving 5-in. conductor spacing. These racks were suspended on a ⅜-in. S.M. messenger and spaced at intervals of approximately 30 ft. Similar racks were also placed at each pole and near or at limbs to prevent the conductors from rubbing against them. Each conductor was dead-ended in a clevis using a similar insulator and sag adjustments were provided by the use of long space bolts at the clevises.

This construction was found to leave sufficient strength to ward off falling limbs that would tear down conventional open-wire construction. Although the flashover characteristics are not particularly high, this line has passed through several severe lightning seasons without trouble. Cost of the construction is less than that for use of aerial cable and approximately three times that for open-wire line with span lengths of 130 to 150 ft.

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Light Flicker Reduced at Low Cost

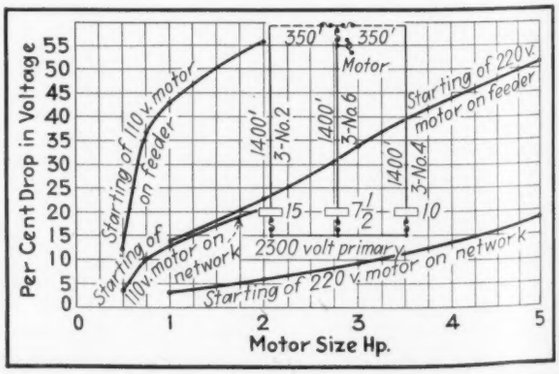
By B. E. ELLSWORTH
Engineer
Iowa-Nebraska Light & Power Company,
Lincoln, Neb.

To improve voltage regulation by banking transformers is easy. To secure satisfactory operation in case of secondary faults with such a system is something else. New secondary fuses recently placed on the market make possible the appplication of the network idea to outlying districts at low cost.

An example typical of a small town having long secondary lines of small copper is given here. The diagram shows three 1,400-ft. secondary leads of different copper size served by transformers of different sizes. A motor located at the end of the middle secondary line (not banked with other two secondaries) starts and produces an excessive voltage drop which flickers lights and is generally annoying. The voltage drop on this No. 6 feeder for 110- and 220-volt motors of different sizes may be so high that lights will continue to burn dimly or flicker as long as the motor is in operation.

The lower two curves illustrate how voltage regulation may be improved, in this case, by building 700 ft. of secondary (shown by dotted lines) and installing three sets of secondary fuses. It will be noted that the voltage drop has been reduced to about one-fourth of its former value.

Secondary fuses have the current



Analysis shows how voltage regulation is improved by closing the ends of secondary runs through fuses

rating of the transformer feeding that respective secondary. This protects the small transformer from becoming overloaded due to shifting of load on secondary faults. The primary fuses on the transformers have a rating of 200 or 300 per cent of the transformer capacity, so the secondary fuses will always blow and cut the transformers apart in case of secondary fault before primary fuses blow.

•

Full Protection With Six Fuse Sizes

By J. M. FLANIGEN
Georgia Power Company, Atlanta

New transformer fuse specifications drawn up by the Georgia Power Company with the express purpose of providing adequate transformer protection without danger of too frequent service interruption and without the necessity of stocking an excessive range of fuse sizes are being widely accepted by manufacturers and operators.

The smallest fuse link to be stocked is the 5-amp. size. Tests showed that if the fuse size was doubled in every step a uniform grading of fuses from 5 to 100 amp. could be attained. This has been departed from, however, in that the 60-amp. fuse is substituted for the 80-amp. size called for. Thus six fuses, 5, 10, 20, 40, 60 and 100, cover the specified range.

INDIVIDUAL TRANSFORMER SIZE - KV.A.	SINGLE PHASE TRANSFORMER INSTALLATIONS				
	2.3-KV. FUSE SIZE	4.6-KV. FUSE SIZE	6.9-KV. FUSE SIZE	11.-KV. FUSE SIZE	13.-KV. FUSE SIZE
3	5	5	5	5	5
5	5	5	5	5	5
7.5	5/10	5	5	5	5
10	10	5	5	5	5
15	10/20	5/10	5	5	5
25	20	10	10	5	5
37.5	40	20	10	5/10	5
50	40	20	20	10	10
75	60	40	20	10	10
100	60	40	40	20	20
150	100	60	40	20	20

INDIVIDUAL TRANSFORMER SIZE - KV.A.	THREE PHASE DELTA TRANSFORMER INSTALLATIONS				
	2.3-KV. FUSE SIZE	4.6-KV. FUSE SIZE	6.9-KV. FUSE SIZE	11.-KV. FUSE SIZE	13.-KV. FUSE SIZE
3	5	5	5	5	5
5	10	5	5	5	5
7.5	10	5	5	5	5
10	20	10	5	5	5
15	20	10	10	5	5
25	40	20	10	10	10
37.5	60	40	20	10	10
50	100	40	20	20	10
75	100	60	40	20	20
100	100	100	40	40	20
150	100	100	100	40	40

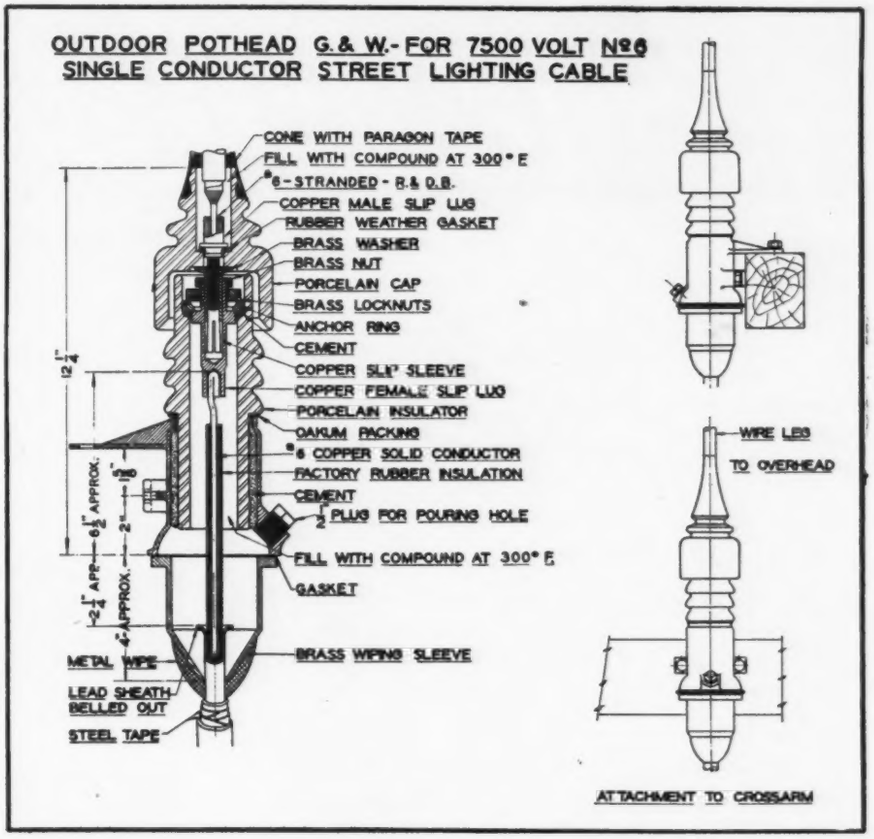
NOTES:-
1-FUSE EACH OUTSIDE LEG OF OPEN DELTA BANK FOR SINGLE PHASE TRANSFORMER CAPACITY INSTALLED IN THAT LEG. MIDDLE LEG TO BE FUSED THE SAME AS OUTSIDE LEG OF LARGER TRANSFORMER.
2-FUSE Y CONNECTED BANK THE SAME AS SINGLE PHASE INSTALLATION. NEVER FUSE NEUTRAL.
3-WHEN ONE FUSE IS BLOWN ON AN INSTALLATION, INSTALL NEW FUSE LINKS IN ALL PHASES OF THAT INSTALLATION.
4-WHEN TWO FUSE SIZES ARE SHOWN, USE THE SMALLER UNLESS FREQUENT BLOWING OCCURS.
5-IF CAPACITY OF A 3 PHASE BANK IS 50% OR MORE OF THE CAPACITY OF THE STATION SUPPLYING THE LINE, USE FUSE TABLE FOR CUSTOMER SUB-STATION BANKS.
6-USE FUSE LINKS ONLY. DO NOT USE FUSE WIRE OR ANY OTHER MAKE-SHIFT ARRANGEMENT UNDER ANY CIRCUMSTANCES.
7-BEFORE REFUSING CLEAN CARTRIDGE WITH A WIRE BRUSH.

Table of fuse sizes for line distribution transformers

In determining fuse sizes for different transformer ratings the customary rule of 1 amp. per kva. was found adequate. For example, the 5-kva., 2,300-volt transformer would be protected with a 5-amp. link, the 10 kva. with a 10-amp. link and a 15-kva. transformer could be fused with either a 10- or a 20-amp. link, as either falls within prescribed limits.

For 2,300-volt transformers in power banks the size of individual transformers is doubled and the ampere per kva. rule applied. A bank of three 5-kva. transformers therefore is supplied with 10-amp. fuses. A bank of three 25-kva. transformers would be fused with 40-amp. links, since that is the nearest size to the actual requirements. For 4,600-, 6,900- and 11,500-volt circuits ½, 1/3 and 1/5 amp. per kva. are specified in the same manner.

Potheads for Street Lighting Cable



In spite of the small size of a 7,500-volt street lighting conductor, the pothead should be installed with as much care as on a heavy power conductor. This is made sure of in Detroit by the following standard instructions of the Detroit Edison Company:

Bill of Material

1 7,500-volt single-conductor outdoor pothead.
1 roll 1½-in. Paragon tape.
5 lb. Filling compound.
½ lb. Rags.
½ oz. Stearine.
1 lb. Wiping metal.
2 ⅝ x 5½-in. bolts.
1 ⅝ x 2½-in. lag screw.
4 ⅝-in. Galv. iron washers.
6 ft. No. 6 Stranded 6/32-in. R.&D.B.
Note—This specification also applies to No. 8 single-conductor cable.

Instruction Sheet

(a) Train cable. Adjust tag.
(b) Saw off end of cable, leaving proper length as shown on drawing.
(c) Remove armoring 12-in. from end of cable.
(d) Mark and crease the lead sheath 8½-in. from end of cable.
(e) Saw off wiping sleeve. Slip wiping sleeve over end of cable and down out of way.
(f) Remove sheath from end of cable to crease. Bell end of sheath.
(g) Remove rubber insulation 2 in. from end of cable. Bend over end of conductor about ½ in. and sweat into copper female slip lug.
(h) Slip body of pothead over conductor and fasten to its support.
(i) Screw brass nut and lock nuts on lug.
(j) Wipe the cable to the wiping sleeve with wiping metal.
(k) Wrap armor tape back in place if loosened and hold with two half-lapped layers of Paragon tape extending from 1 in. below end of outer covering of cable to bottom of wipe.
(l) Fill the lower part of the pothead with filling compound at 300 deg. F.
(m) Sweat the No. 6 stranded lead to the overhead into the copper male lug.
(n) Insert male slip lug in porcelain cap and screw on copper slip sleeve.
(o) Fill porcelain cap with compound at 300 deg. F.
(p) Wrap Paragon tape over porcelain cap and No. 6 w.p. wire as shown on drawing, making a cone about 6 in. long.
(q) Attach tag in proper location.

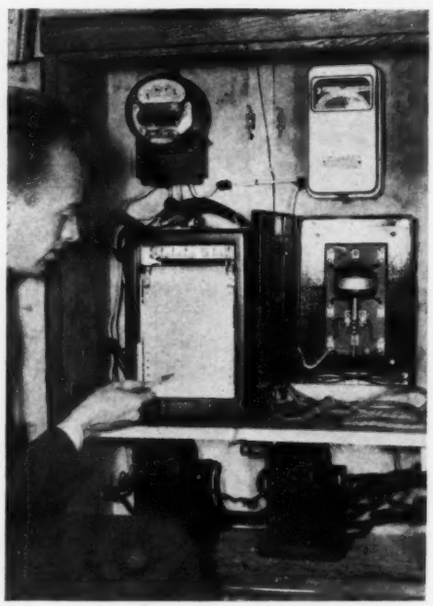
Building Up THE LOAD

New ideas and practices in selling electrical equipment and service to industrial, commercial and domestic customers

One Chart Records Water, Power Load

Graphic wattmeters were placed on twelve typical electric water heater installations by the Department of Water and Power of the city of Los Angeles in order to determine representative operation. Reproduced here is a chart covering twelve hours, from a Wednesday noon to midnight, on a load consisting of an 8-kw. range, an electric refrigerator, a 42-gal. water heater and the lighting. The heater was of the two-element type, the upper element having a capacity of 2,100 watts and the lower element 1,050 watts. The time switch was set and wired to control the lower element, off at 4:30 p.m. and on at 9:30 p.m.

The wattmeters were equipped with chronograph pens, and by means of a contact on the dial of the water meter one pen was made to record the number of cubic feet of water drawn from the heater. The one chart therefore shows both the water and the electrical demand. This type of chart was used during a ten months study of twelve installations. The record of draw-off correlated with demand, and the fact that each occurrence was accurately timed eliminated any guesswork or assumption.



Meter installation for analyzing water heater load

After analyzing individual charts and tabulations which summed up the simultaneous effect on the system from the twelve installations, a requirement of water heater size was determined in accordance with the combinations of bathrooms and bedrooms in a house as shown in the following table:

Number of Bedrooms in House	Size of Tank in Gallons — Number of Bathrooms Served						
	1	2	3	4	5	6	7
1	30	...	...	...	...	...	...
2	40	50	...	...	...	...	...
3	50	60	70	...	...	...	...
4	65	75	85	95	...	...	...
5	...	90	100	110	120	...	...
6	...	...	110	120	130	140	...
7	...	...	125	135	145	*	*
8	...	...	140	*	*	*	*
9	...	...	*	*	*	*	*

In order further to analyze the actual effect of the heater installations on the system peak, each installation made is charted for one week with a graphic meter, and the bureau now has data on some two hundred installations.

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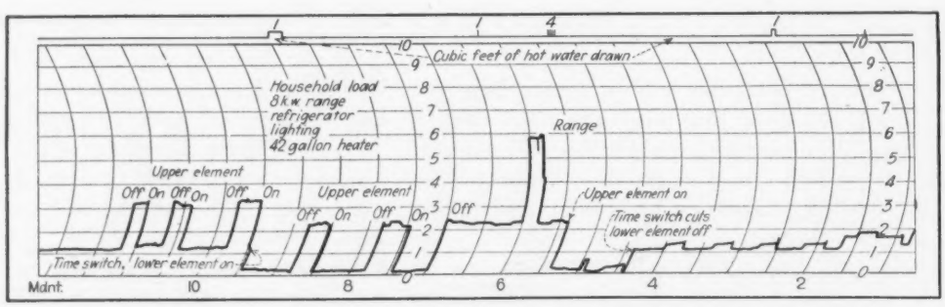
Load-Building Tips From Across the Sea

Between-session chats with several of our European friends at the recent World Power Conference netted us some interesting bits in the way of foreign load and good-will building practices.

One European utility executive while maintaining the good-will of his veteran customers insures that of his newest customers by keeping close tabs on the marriage license bureau in his territory. One shiny new inexpensive electric flatiron goes to each bride with his company's compliments as soon as possible after the ceremony. Of course it is delivered by a home service sales-



Water draw-off and electric load of an electric heater

Showing the Trend to SILVER

for current-carrying contacts that stay cool—

that will eliminate your oxidation troubles

"They tell me that G.E. puts silver contacts on almost everything."
ose are our new G-E Re-
—with silver contacts."
"In a chemical atmosphere such as we have, switchgear with silver contacts is the only thing."
"Those silver-contact disconnecting switches sure stay cool. They've licked Old Man Oxide."
"—and even these little G-E control switches have silver contacts."
Silver-contact breakers for trainloads of G-E metal-clad switchgear.

8-90-15

GENERAL ELECTRIC

woman, who usually finds time to mention other appliances and help the bride with her cooking suggestions. This executive also implied that a nursing-bottle warmer often follows—later, also free.

Electric refrigerators that are built into new homes in Great Britain and financed over a long period of years as a part of the house mortgage were also mentioned. Side walls and backs of these refrigerators are part of the house and thus logically the appliance is part of the structure.

One of the British delegation mentioned the fact that he has found it profitable to rent electric water heaters for about 25 cents a month. Of course the units are not large, they are 1½-gal. capacity and fit snugly under the lavatory. They are large enough, however, to meet most ordinary personal needs for hot water. Rated at about 750 watts, they consume approximately 150 kw.-hr. each month. Once installed, the customer usually regards it as indispensable and frequently finds it to his advantage to have a larger one installed.

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Detroit Cultivates Small Store Owner

Foremost among the total number of commercial and industrial lighting customers is the customer who never sees an architect, whose business is a small one and who probably will never be a prospect for an outstanding installation. In other words, the "average small customer" is, in the final analysis, one not to be neglected either from the standpoint of continuing his good will or from the standpoint of future increases in business.

In a paper before the Michigan Electric Light Association Henry A. Cook, Detroit Edison Company, set forth the results of a sales campaign designed to cultivate these average small customers. Among other data presented were figures on the results of this campaign as affecting small stores.

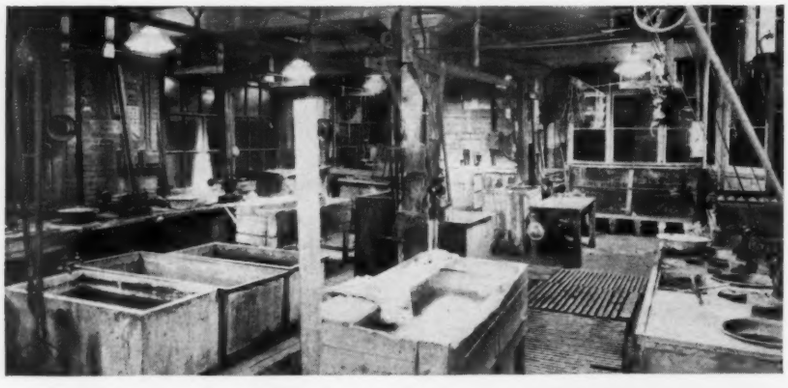
During the campaign two salesmen were designated to interest small store owners in better lighting, proper use of existing fixtures and the purchase of new equipment. Activities of these men were supplemented by five direct mail pieces stressing the advantages of show-window and store lighting as a selling tool. The men following up the mail pieces offered to replace lamps of improper size with those of proper size for the fixture in use. Where fixtures were inadequate, an effort was made to interest the customer in the purchase of new equipment. In all cases empty sockets in active areas were filled.

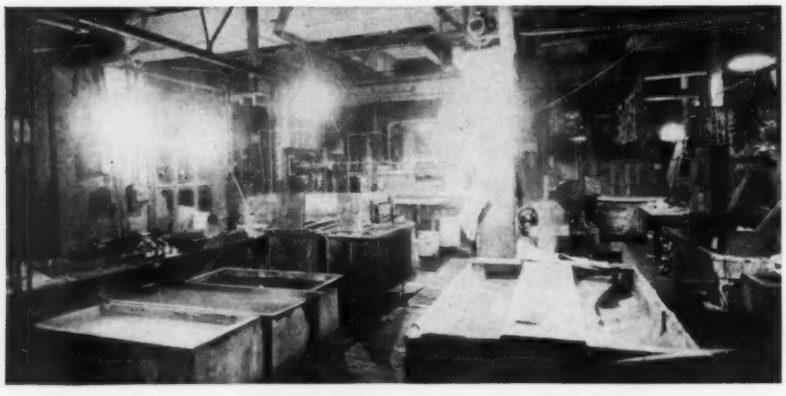
Efforts of these two men over a twelve-month period added 361 kw. of load, the estimated annual kw.-hrs., being 684,920 and the estimated annual revenue $21,207. The cost per dollar of estimated annual increased revenue was $0.23. Approximately 20 per cent of the customers contacted made changes in their lighting system. The annual increase in revenue per customer sold was $51.72.

Having indicated that it pays to cultivate the small customer, an analysis of this market in Detroit was made by individuals not directly connected with the lighting service division.

Customers in Detroit included in the small store group total 46,700. Of these about 48 per cent are located in fairly dense areas. There are, therefore, 22,416 customers who can be contacted in the prescribed manner. As a result of the year's experience it can be assumed that 20 per cent of these will make changes in the use of their lighting systems. Since 2,416 have already been contacted, a potential increase of 40,000 customers capable of producing an additional annual revenue of $200,000 exists. This market requires no additional expense from the standpoint of service, metering, etc., and is a profitable one to cultivate.

Better Lighting Is Safer Lighting





Average illumination 5 ft.-candles, dangerous conditions imposed by lack of light in a room crowded with vats of chemicals and boiling water, all work requiring discrimination had to be performed near the windows—these were the conditions in the plating department of the Colonial-Premier Company, Chicago, before the Commonwealth Edison lighting engineers converted the lighting installation. Now the average light intensity is 25 ft.-candles, there are no dark shadows obscuring the walk-ways between the vats and the men can do better work and do it in greater safety because they can see what they are doing

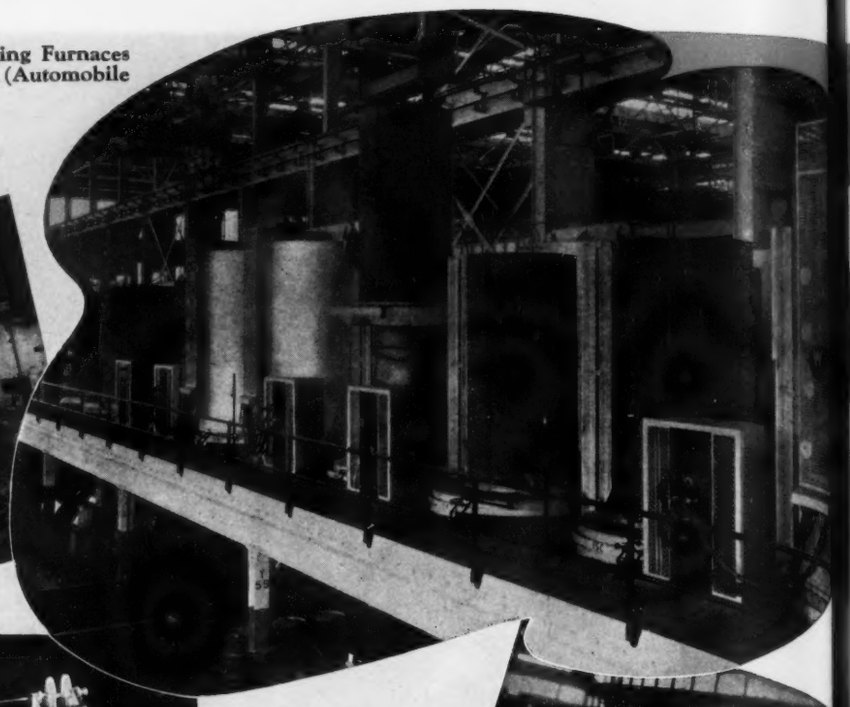
The dry and blistering desert air, and the grinding sand-blast storms, are staunchly endured by the tough, protecting coat of The Cactus. . . . Likewise, the nibbling, gnawing oxygen has little effect on heating-elements made of Chromel. This alloy of nickel-chromium forms its own protective skin which the air can scarcely penetrate—and thus comes Chromel's noted durability. Thus also, your profitable heating load is safely protected by Chromel—to which the good-will value of priceless trade-names is entrusted, by the device makers. . . . In Catalog-KW is useful information on heating-unit design. Send for a copy. . . . Hoskins Manufacturing Co., Detroit, Mich.

H O S K I N S

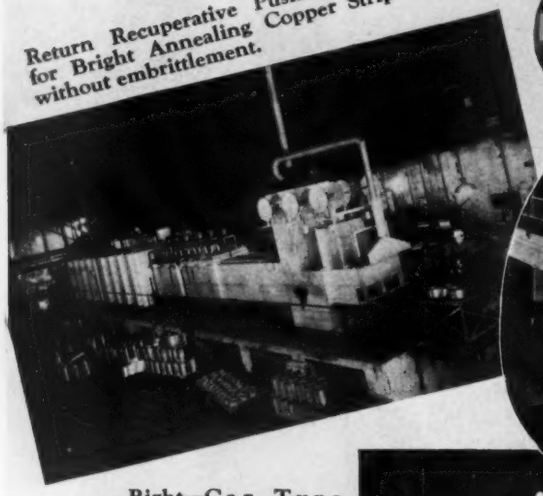
CHROMEL

THE *wire* THAT MADE ELECTRIC HEAT POSSIBLE

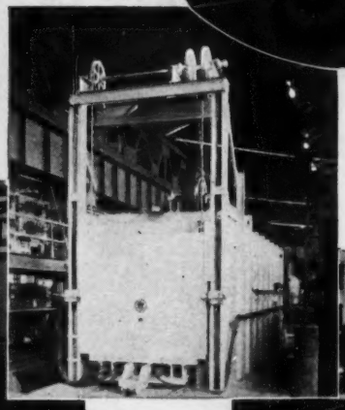
Bell-Type Bright Annealing Furnaces for Low Carbon Strip Steel (Automobile Body Stock).



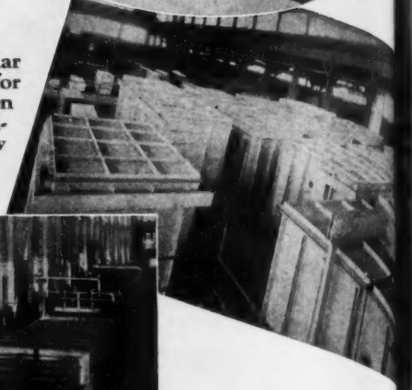
Return Recuperative Pusher Type Furnace for Bright Annealing Copper Strip in Coils without embrittlement.

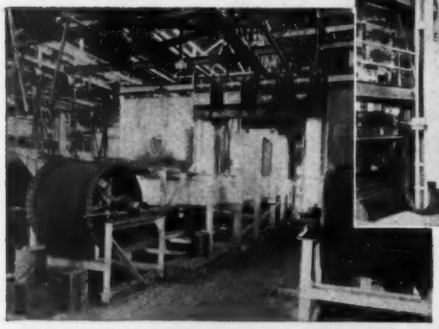


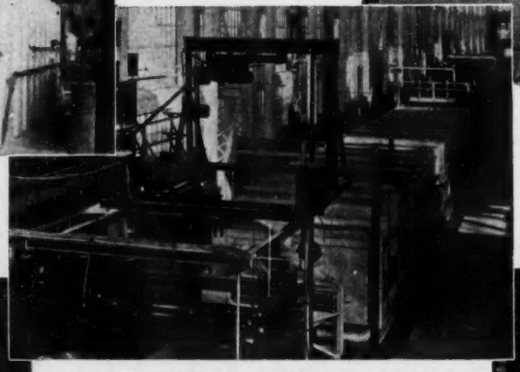
Right—Car Type Furnace for Heat Treating Alloy and High Carbon Tool Steel.



Right—14 Rectangular Bell-Type Furnaces for Annealing Silicon Steel. Twelve additional units are now being installed.

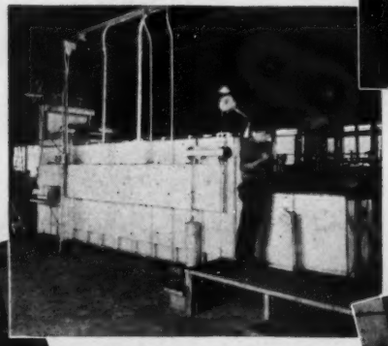






Below—Copper Brazing Furnace for Small Parts.

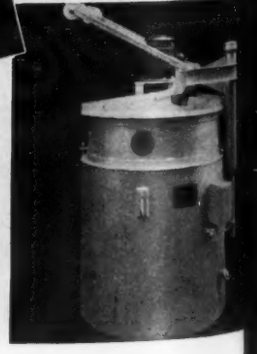
Continuous mesh belt conveyor furnaces for annealing non-ferrous parts.



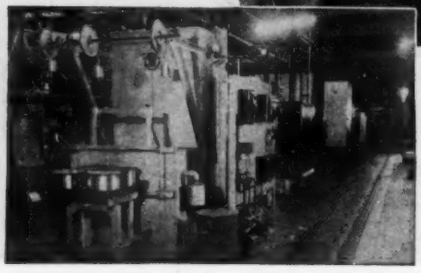
5-ton per hour, 227-foot continuous Bright Strip Normalizing Furnace. Now installing a second furnace 7½ tons per hour, 325 feet long.

Belt Conveyor Furnace for hardening bolts and nuts free from scale.

Below—Air Tempering Furnace with High Pressure Recirculation.



Bell-Type Furnace for Bright Annealing Copper Wire on Spools.



Bell Furnaces for Bright annealing High Carbon Strip and Rod stock without decarburization.

Left—Continuous pusher furnace for bright annealing copper wire.

A BACKGROUND OF SPECIALIZED KNOWLEDGE *for* EVERY HEAT-TREATING APPLICATION

● The part that heat-treating plays in the final quality of metal products, and in the reputation which they enjoy among customers, can scarcely be over-rated. It is but logical, therefore, to expect from your supplier of heat-treating equipment benefits that can come only from *a background of specialized knowledge* and diversified experience. Westinghouse has that background!

For many years, Westinghouse has been in the business of making *better* electric furnaces for *more efficient* operation on *every type* of heating application . . . years devoted to continuous research and development, including an intensive study of heat-treating requirements under all kinds of service conditions . . . years of making improvements and of consolidating advanced theory with actual operating experience . . . both in Westinghouse plants and throughout industry . . . years of fulfilment in the progressive design and installation of *heat-treating systems that lend perfection to processing technique.*

Against that background Westinghouse is ably qualified to undertake the solution of any electric heat-treating problem . . . to assist you in the selection of equipment best adapted to your particular situation. Westinghouse industrial heating specialists are ready to serve you. Let one of them make a detailed study of *your* requirements and without obligation recommend the furnace to fit your application.

J 10010

WESTINGHOUSE ELECTRIC & MANUFACTURING CO.
INDUSTRIAL HEATING DIVISION EAST PITTSBURGH, PA.

Westinghouse

WESTINGHOUSE 1886 W 1936 GOLDEN JUBILEE

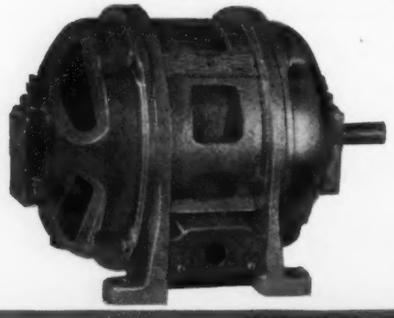
BUY MACHINERY DRIVE LIKE TIRES

● Look for the three most important money-saving *mileage* features when you have occasion to purchase an electric motor . . . and your choice will invariably rest with Westinghouse alone. GREATER FRAME STRENGTH protects motor life against vibration, torque and strain, despite difficult applications. SEALED SLEEVE BEARINGS eliminate the *cause* of most motor wear—guarantee savings in replacements, oiling and shutdowns—they require oiling at only the rarest intervals, effectively seal out dust and dirt to make wear a negligible factor. DUAL-PROTECTED WINDINGS safeguard your investment against all damage, *electrical* or *mechanical*. For complete information, call or write your nearest:

WESTINGHOUSE OFFICE WESTINGHOUSE JOBBER
WESTINGHOUSE INDUSTRIAL AGENT

- *Extra Frame Strength*
- *Dual-Protected Winding*
- *Sealed-Sleeve Bearings*

The steady demand for *more mileage* has improved automotive tire mileage quality beyond conception in recent years. Convert the *turning* motion of an electric motor during its lifetime into *distance* and you will obtain another interesting *mileage* figure. Three important electric motor features combined *only* by Westinghouse, will give you *more* mileage—more years of trouble-free motor service.



J 20077

Westinghouse

THE MODERN DRIVE
FOR MODERN MACHINERY

WESTINGHOUSE 1886 1936 GOLDEN JUBILEE

Industrial ELECTRIFICATION

New ideas and practices in industrial electrification as presented by industrial, consulting and power sales engineers

Better Light Yields More, Better Wire

With an increase in general illumination from 12 to 30 ft.-candles spoilage and rejection in the wire covering department of the Westinghouse Electric & Manufacturing Company has been cut 50 per cent. Better lighting in facilitating a real visual inspection of the covering process has permitted flier or spinner speed on some of the machines to be stepped up from 2,000 to 4,500 r.p.m.—a real step-up in production.

This department occupies approximately 9,000 sq.ft. of floor space on the ground floor of a brick and steel four-story building. Lighting is provided by 500-watt Glassteel-diffusing units mounted 12 ft. from the floor and spaced on 10-ft. centers. In all 80 units totaling 40 kw. are installed and controlled by panelboards with 14 Nofuse breakers per board. Circuits are arranged with switching lengthwise of the building so lights may be turned off in rows parallel to the windows when daylight intensity is high enough that lights along the window area are not needed.

To obtain high light reflection value walls and ceilings are painted with white Dulux. To insure cleanliness air-conditioning equipment has been installed. The storeroom where cotton is kept preparatory to use is equipped with humidifying apparatus to keep cotton in the proper condition for spinning.

This department cotton covers round wire sizes from No. 12 to 36 using cotton No. 60 to 120; it also silk covers wire sizes No. 16 to 36 using silk sizes Dennier Nos. 5, 6 and 7 or paper 0.001 in. thick.

An increase of 18 ft.-candles cuts rejects in half and makes a boost in production possible in wire covering process

Synchronous Motors Simple to Start

By K. B. HUMPHREY
Sayreville, N. J.

Occasionally an industrial plant is hesitant about installing synchronous motors for fear that the starting operation is complicated and beyond the capabilities of the ordinary workman. Control apparatus for synchronous motors which is entirely automatic and involves only the pushing of a button is available, but there are still the manual control installations to consider.

The starting of this type of motor involves, as a rule, three steps:

(1) Throwing in the starting switch which connects the stator winding to the lower voltage tap on the compensator and starting the motor as an ordinary squirrel cage motor; (2) applying full voltage and bringing up the speed to within a few per cent of synchronous speed, and (3) throwing in the direct-current field switch, at which point the motor pulls into step and operates at synchronous speed.

With the ordinary manual control two switches are employed which are mechanically interlocked so that the starting switch must be put in first and the running switch cannot be thrown in until the starting switch is out.

It is simple to instruct almost any intelligent workman in the starting cycle, and after one or two trials there is never any trouble experienced in starting. The starting switch is thrown in and the motor allowed to come up to speed, the starting switch is then thrown out and the running switch in. At this point it will be noticed that the d.c. ammeter needle swings back and forth at a decreasing rate. As the pulsations become slower the field switch is thrown in and the motor pulls into step. In starting

the first time it will be found that the d.c. field rheostat must be adjusted.

With the motor running idle the field should be adjusted until the current on the a.c. ammeter is at the minimum point. Either an excess of field current or too little field current will cause an excess current to be shown in the main a.c. ammeter. If the field is once adjusted, however, it is not necessary to make any changes and it is customary to have a mark on the d.c. ammeter showing the correct field to carry, and if there does happen to be a change the operator adjusts the field rheostat to the mark. The average synchronous motor will operate through quite a wide range of d.c. field values and therefore, in order to make the correct power-factor correction, it is necessary to determine what value is to be carried. The original adjustment should be made by some one who thoroughly understands what the desired operating conditions are.

In one large plant where there are several large synchronous motors one or two men in each department are instructed in the starting cycle and are required to adjust the field after starting to a predetermined value if necessary. All changes of excitation are made by the electrician and each day the electrician looks over the motor and sees to it that everything is operating properly.

•

Hints on Design of Industrial Wiring

Electrical power applications in industry are so numerous and diversified that it is almost impossible to compile specific standards for industrial wiring that will cover all cases. However, a power wiring installation may be considered adequate, according to the Master Electrical Specifications recently published in *Electrical Contracting* (Volume 35, No. 8), when due weight has been given to the following factors: (1) Safety and reliability; (2) avoidance of excessive voltage drop; (3) avoidance of excessive copper loss; (4) flexibility in meeting changing equipment locations; (5) provision for supplying increased loads.

Concerning safety and reliability, the National Electrical Code specifies that conductor sizes for motor branch circuits shall have a current carrying capacity no less than 125 per cent of full load current of the motor. Conductors for services, feeders or subfeeders should have a carrying capacity of no less than 125 per cent of the full load current of the largest motor plus the sum of the full load currents of all other motors.

To insure proper operation, total voltage drop from the service entrance to any motor should not exceed 5 per cent. In conductors supplying any industrial electric heater voltage drop should not exceed 2 per cent. For high wattage heaters the maker and the utility company serving the installation should be consulted to determine the allowable drop. Permanently connected, electrically heated appliances rated at 1,000 watts or less may be supplied from appliance branch circuits. Total connected load on such a circuit, however, should not exceed 25 amp. Heaters rated between 1,000 and 5,000 watts may be supplied by heavy-duty appliance branch circuits. No more than four appliances should be supplied by one such circuit nor should total load exceed 60 amp. Appliances rated at more than 5,000 watts should be supplied by individual branch circuits. In each of the foregoing cases the voltage drop from distribution center to any outlet should not exceed 2 per cent.

Some degree of flexibility in industrial wiring systems may be secured to meet changing equipment locations by using one of the following systems: (1) Busways arranged for use of plugging in device; (2) wireways carrying feeders and motor branch circuits; (3) an underfloor raceway system where a large number of small motors are to be supplied; (4) oversize raceways where changes in motor sizes are anticipated.

Items to be considered in making provision for supplying increasing loads should include provision for service, feeders and subfeeders large enough to provide some excess capacity over present needs. Raceways may be installed of sufficient size to permit the installation of conductors that will provide a definite increase in capacity. Demand factors of less than 100 per cent should seldom be applied. Panelboards should be of the sectional type with interchangeable units, permitting the substitution of units of larger ratings. Distribution centers consisting of switchboards or assemblies of switches or circuit-breakers should be designed so that original control units can be replaced by units of larger size and that provision can be made for the control of additional circuits.

•

Simplified Sewage Pump Speed Control

At the sewage treating plant at Huntington Park, Calif., a modern motor application typifies the savings possible with new industrial equipment. There automatic, variable-speed control of two pumping units has solved the problem of handling raw sewage effectively. Inflow of sewage varies considerably during the day from a peak of five times the average flow to a minimum of 50 per cent of the average flow. It flows into a wet well and from there is pumped into a sedimentation tank for treatment. The pumping units for this operation are driven by Sterling power units consisting of an induction motor combined with a V-belt double pulley drive and arranged so that the diameter of the pulleys can be changed simultaneously and thereby vary the output shaft speed of the unit. The speed-changing mechanism of the unit is chain-driven by a small pilot motor, which in turn is controlled through a resistor actuated by a float in the wet well.

Advantages of the system are the compactness of the installation, which saves on building size and first costs; a more even flow through the process, and the elimination of labor and maintenance. Formerly various sizes of pumps had to be installed to take care of the variable pumping conditions encountered in these plants.

Changes in the wet well level initiate corresponding speed changes of the sewage pump motors

Rate of pumping corresponds with the rate of inflow. One unit operates constantly, with the second picking up when the flow increases beyond the capacity of the first.

First COST IS last COST

● When you buy a Westinghouse Type TA Industrial Analyzer, you can rest assured that no more equipment will be necessary for making complete a-c. circuit tests up to 125 amperes, 600 volts. Instrument investment not only is reduced to the minimum, but also no further expenditure will be necessary in the future. This analyzer eliminates hundreds of dollars worth of individual portable instruments otherwise necessary.

Self-contained in a light weight, easily-carried case, it raises testing to a new level of efficiency and economy by assuring:

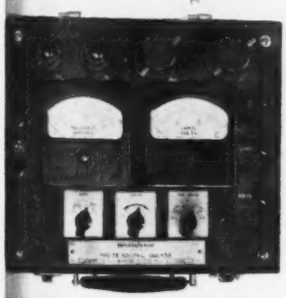
ACCURATE TEST DATA—The only connections made by the tester are to the load and the power source. Thus, errors arising from the maze of connections required with individual instruments are eliminated. Even an inexpert tester can use the Westinghouse Industrial Analyzer with reasonable assurance of accuracy.

EASY, ACCURATE READING — All instrument scales are confined within an area only 7 by 8 inches. Simultaneous readings can be obtained quickly and accurately.

COMPLETE TEST DATA—Because individual instruments are not available and are inconvenient to transport, important data is often neglected. A test in which missing parts are estimated is practically worthless. But testing with the Analyzer is so simple and easy that there is no excuse for incomplete and inaccurate test data.

REDUCED OPERATING COSTS—Testing time is cut at least in half. Since more time is available, more tests can be made . . . more faults corrected. And more faults corrected mean more money saved.

For detailed information about the Westinghouse Industrial Analyzer, just ask for a copy of C. S. 43-145. Room 5-N, East Pittsburgh, Pa. J 40051



D-C. Analyzer—Self-contained for making d-c. measurements from 0-750 volts, 0-750 amperes, and ½ to 600 hp. Ask for C.S. 43-146.

Westinghouse

QUALITY — WESTINGHOUSE — 1886 W 1936 — GOLDEN JUBILEE — METERS INSTRUMENTS RELAYS

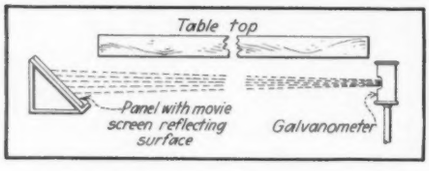
New ENGINEERING IDEAS

Discoveries, proposals and developments by electrical engineers and scientists in the field, the factory and the laboratory

Screen Sharpens Galvanometer Image

By C. E. MILLER
Testing Laboratory
Commonwealth Edison Company, Chicago

Brightness and sharpness are most desirable in the image projected by a vibration type galvanometer because with a fuzzy image it is difficult to be certain when it has come to absolute rest. Observation of the image through a ground glass and changes in beam direction by means of mirrors or prisms all result in loss of image sharpness and to greater or less degree reduce the accuracy of observations depending on the quality of the glass and mirrors or prisms and their number. The obvious cure for such errors is to design the galvanometer set-up so that no changes in beam direction are necessary and to find a better medium than ground glass for reception of the beam.



Improved galvanometer arrangement

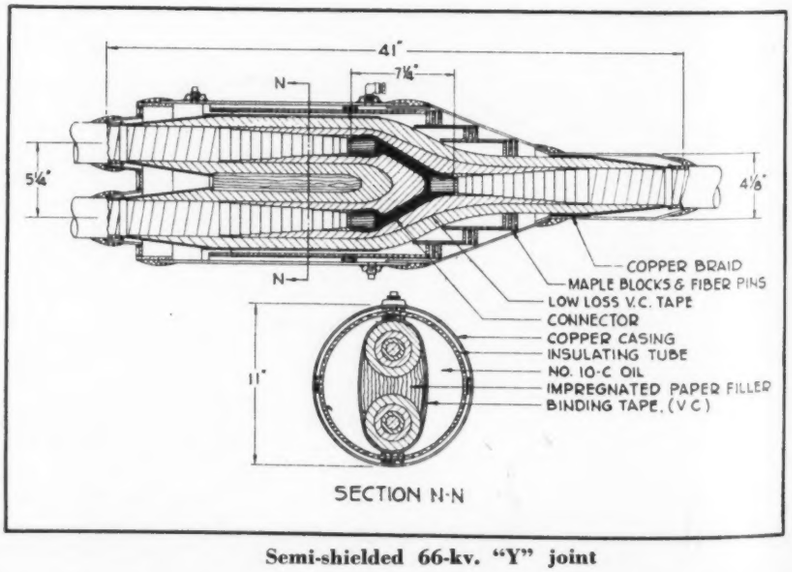
Both of these objects are realized in a bridge test table devised and installed in the testing laboratory of the Commonwealth Edison Company. The galvanometer arrangement of this table is shown in the accompanying sketch. The galvanometer beam passes under the table top and the image appears on an inclined surface conveniently visible to the operator as he manipulates the bridge controls on the table. The surface on which the image appears is not finished in any old way that happens to be most handy, but is a very special surface indeed. It is a surface of very finely divided aluminum applied to a metal panel as a paint. The paint is that which is used on the best quality moving-picture screens. It is worth while to take considerable pains to obtain the very best paint of this kind because the difference in clearness and sharpness of the image is very marked as between just ordinary aluminum paint in which the metal is contained in the form of flat scales and the more expensive screen coatings in which the aluminum is carried in diversely irregular crystalline shapes. The brightest image is obtained when the panel is placed at an angle at which a mirror would reflect the galvanometer image to the eyes of the operator. The type of panel described may be used in other positions and it may be calibrated for use with deflecting type galvanometers.

•

Develops 66-Kv. "Y" Cable Joint

By HERMAN HALPERIN
and R. J. PATTERSON
Commonwealth Edison Company, Chicago

According to a tentative plan of the Commonwealth Edison Company of a few years ago, a tap 1½ miles in length would be made to an underground, single-conductor, 66-kv. line in order to supply power to a distributing station thus to avoid looping the line into the station, which would require two circuits. Accordingly, two designs were prepared and tests started to de-



Semi-shielded 66-kv. "Y" joint

. . . . BUILT LIKE A BRIDGE

This New Improved Murray Crowsnest

ENGINEERED AND BUILT TO STAND ALL STRESSES

Photograph above shows ten men standing on lower section of Murray Crowsnest, proving its extreme rigidity and ability to meet abnormal strains.

Here's a ladder-rig of unique design . . . built of sturdiest materials throughout . . . engineered for super-safety.

Uprights in both sections are of airplane Sitka spruce of Army and Navy specification. Rungs are of hickory, reinforced with steel rods and new type combination ferrule-brace attachments. Trusses provide additional strength to meet any extraordinary demands of service.

It's an outstanding value. Savings in maintenance expense repay its first cost in a short time. One man operates it . . . up or down in a jiffy. Hundreds of working positions. Mountable on any light commercial truck. Price: $325.00 f.o.b. Brooklyn, N. Y.

Write for operating and construction details of this widely used ladder-rig.

METROPOLITAN DEVICE CORPORATION, BROOKLYN, N. Y.

FOR

Servicing Street Lights
Servicing Traffic Lights
Connecting Services

FOR

Tree Trimming
Line Inspection
Light Construction Work

MURRAY DEMOUNTABLE CROWSNEST

termine whether a successful joint could be developed.

One of the joints tested includes a bifurcating cast copper connector into which the conductors of the three cables are soldered as shown in the accompanying illustration. Stepping of the cable insulation is done in the same manner as for normal 66-kv. joints:

Low-loss varnished-cambric tape is applied in the regular manner except at the crotch of the connector. Here, in addition to circumferential wrappings of tape, horizontally applied strips of V.C. tape were included in the taping in order to obtain a compact mass of insulation in this region without excessive void spaces. The space between the two parallel cables on the double branch side of the joint is filled with longitudinal layers of impregnated paper insulation. This material was obtained from multiple-conductor cable filler insulation. The tape slopes at the ends of the joint were shielded with copper braid. A nest of insulating tubes is included for both insulation and mechanical strength purposes. A four-piece copper casing is used because of the large diameter employed and because of the weight of the joint.

The second joint is of similar design, except that it is completely shielded with copper braid, no filler material being used between the two parallel branches. The length of both joints is 41 in. The joints were evacuated for half an hour and back-filled with No. 10-C oil.

The single-branch end of each joint terminated in a pothead and the double-branch ends were connected in parallel so that the current flow in each of the latter conductors was half of that in the single one.

The joints have been subjected to accelerated aging tests of 42 cycles to date. The usual cycle was ten hours of heating, followed by fourteen hours of cooling. Maximum copper temperatures for the two cables connecting the parallel branches ranged from 28 to 40 deg. C., while the copper temperature of the cables on the single-branch terminal ends ranged from 50 to 70 deg. C.

For seventeen of the cycles the test voltage was 86 kv. between conductor and sheath, and for the remaining 25 cycles the test voltage was 95 kv., or 2½ times operating voltage. Curves of power factor and ionization factors for the two joints indicate that both joints were stable throughout these severe tests. At 95 kv. the maximum values of power factor obtained for the shielded and semi-shielded joints were about 1.5 per cent and 1.15 per cent, respectively. The maximum value of ionization factor (increase in power factors between 15 kv. and 86 or 95 kv.) obtained on either joint was only 0.05 per cent at room temperature.

Test results indicate that it is feasible to develop "Y" joints for operation on single-conductor cables of the ordinary type to at least 66 kv. Such joints have reasonably small dimensions. Of the two designs, the preference is for the semi-shielded type because of the increased chances for failure with the shielded design due to improper taping in the crotch region, where the correct application of tape is both tedious and difficult.

•

Concrete Tower Fill Stops Boys Climbing

To end a series of fatalities on steel poles the central lacing of which encouraged children to climb, the Salt River Valley Water Users Association, Phoenix, Ariz., filled the central portion of these poles with concrete to a distance of 8 ft. above the ground. Reduction of the accident rate to zero and low cost of installing the safety measure are the successful results.

Children deterred from climbing by concrete fill

The association maintains a distribution system embracing 1,000 miles of 2,300-volt secondary line, carried on steel poles with central bracing. It was on these that kites, or simply the urge to be taller than some one else, led children to scale the central bracing, too frequently with disastrous results.

A five-man crew placed the bases. Three men placed forms and removed them after setting the concrete. Equipment included a 7-cu.ft. concrete mixer, a material truck and 100 sets of forms. These were in two pairs, each 4 ft. long. They consisted of four 4-ft. pieces of 1x12 and eight pieces of 2x4 slotted at the ends to accommodate bolts which could be fastened quickly with wing nuts.

Concrete required per pole was about ¼ cu.yd. The mix was 1:2½:5. Aggregate was of 1-in. maximum. It was found that 66 poles could be concreted in a nine-hour day. Cost for the first 1,200 poles, including forms and miscellaneous items, was $2.786 per pole. Cost for the total of 4,800 was estimated to average $2.25 per pole.

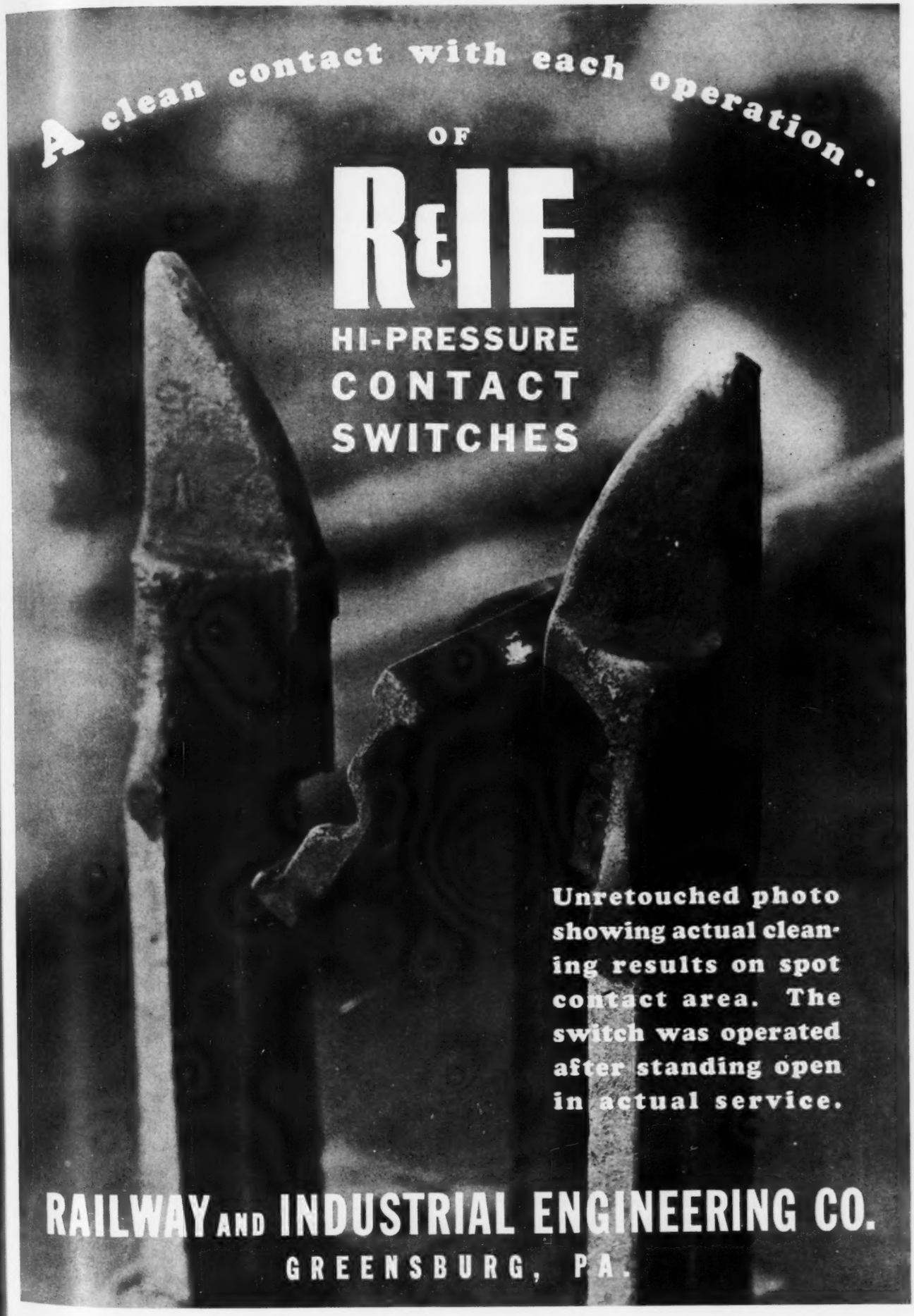
•

Photo-Electric Cell Used to Tab Autos

Traffic counters using infra-red rays and an electric eye have brought the more abundant life to traffic census men in eleven states. These states are already compiling statistics obtained through the use of these recorders, as part of the Highway Traffic Inventory and Planning Survey under the direction of the Federal Bureau of Public Roads. Although the recorders are intended for use in analyzing traffic flow, they can be used, in a slightly modified form, for counting and timing production.

Two light sources, several feet apart, project parallel beams of light across the road, after they have first been passed through filters to remove all but the invisible infra-red heat rays, to avoid annoying or surprising pedestrians who may pass the recorder. The beams fall on two mirrors in the ends of a horizontal periscope and are reflected onto a single photo-electric cell. Unless both beams are interrupted at the same time the cell will not function; thus the device is protected against pedestrians with an eye toward "fun."

The photo-electric cell actuates a mechanism which counts the passage of each vehicle. At the end of an hour the cumulative total is stamped on a tape, together with the hour and the day of the week. The device can register up to 400 impulses a minute and can record a total of 99,999 impulses. It contains a 30-day supply of tape and, if the attendant forgets, can operate for eight days at a time without attention. It operates on 110-volt current and in the case of power failures records on the tape the hour of such failure. It is a product of the International Business Machines Corporation.


A clean contact with each operation..
OF
R&IE
HI-PRESSURE
CONTACT
SWITCHES
Unretouched photo showing actual cleaning results on spot contact area. The switch was operated after standing open in actual service.
RAILWAY AND INDUSTRIAL ENGINEERING CO.
GREENSBURG, PA.

News ABOUT PEOPLE

W. C. McWhinney Assumes New Executive Duties

W. C. McWhinney, commercial manager of the Southern California Edison Company for the past six years and a member of the company organization since 1909, has been appointed assistant vice-president, public relations department. Succeeding

Mr. McWhinney, C. E. HOUSTON, formerly assistant commercial manager, has been appointed commercial manager. Announcement of the changes was made by Fred B. Lewis, vice-president and general manager. In his new position Mr. McWhinney will be associated directly with Will H. Fischer, vice-president in charge of public relations. The office is new in the Edison organization, effecting consolidation of activities.

•

▶GEORGE A. WIEBER has been appointed manager of the northern division of the New York Power & Light Corporation to succeed Thomas W. Drought, recently elected vice-president of that utility. Mr. Wieber became associated with New York Power & Light in 1929. Formerly he had been connected with the Westinghouse Electric & Manufacturing Company, New York Edison Company and the Utica Gas & Electric Company. Mr. Wieber was graduated from Brooklyn Polytechnic Institute in 1915. Then he entered the employ of Westinghouse.

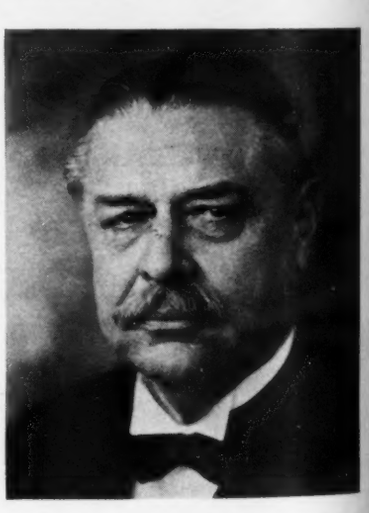
▶C. J. HURD, formerly agricultural engineer of the Mountain States Power Company, Albany, Ore., and the California Oregon Power Company, Medford, has left this position to join the agricultural industries division of the Tennessee Valley Authority at Knoxville, Tenn. Mr. Hurd was one of the first agricultural engineers to be employed by utility companies in the Northwest and did much toward advancing rural electrification in western Oregon.

▶ JAMES F. BEAL has joined the staff of the Bryant Electric Company, Bridgeport, Conn., and is at present located in Chicago. For the past nine years Mr. Beal has been a member of the Underwriters' Laboratories, Chicago office. He has been secretary of the Illinois chapter of the International Association of Electrical Inspectors for a number of years.

▶R. A. HOBSON, JR., of Richmond, until recently associated with the P.W.A. in Richmond, has been appointed P.W.A. project engineer at the Pinnacles of Dan hydro-electric project. Mr. Hobson has assumed his duties and will act as liaison officer between the Pinnacles and the federal government. After five years with the Public Service Corporation of New Jersey, he returned to Richmond as assistant construction superintendent of the original du Pont plant at Ampthill. Afterward he spent several years with the firm of Chase & Waring, consulting engineers of New York. He became associated with the P.W.A. office in Richmond when it opened.

Tablet Dedicated to Memory of George Ward

Ceremonies commemorating the outstanding service of the late George Clinton Ward, construction engineer and former president of the Southern California Edison Company, were held



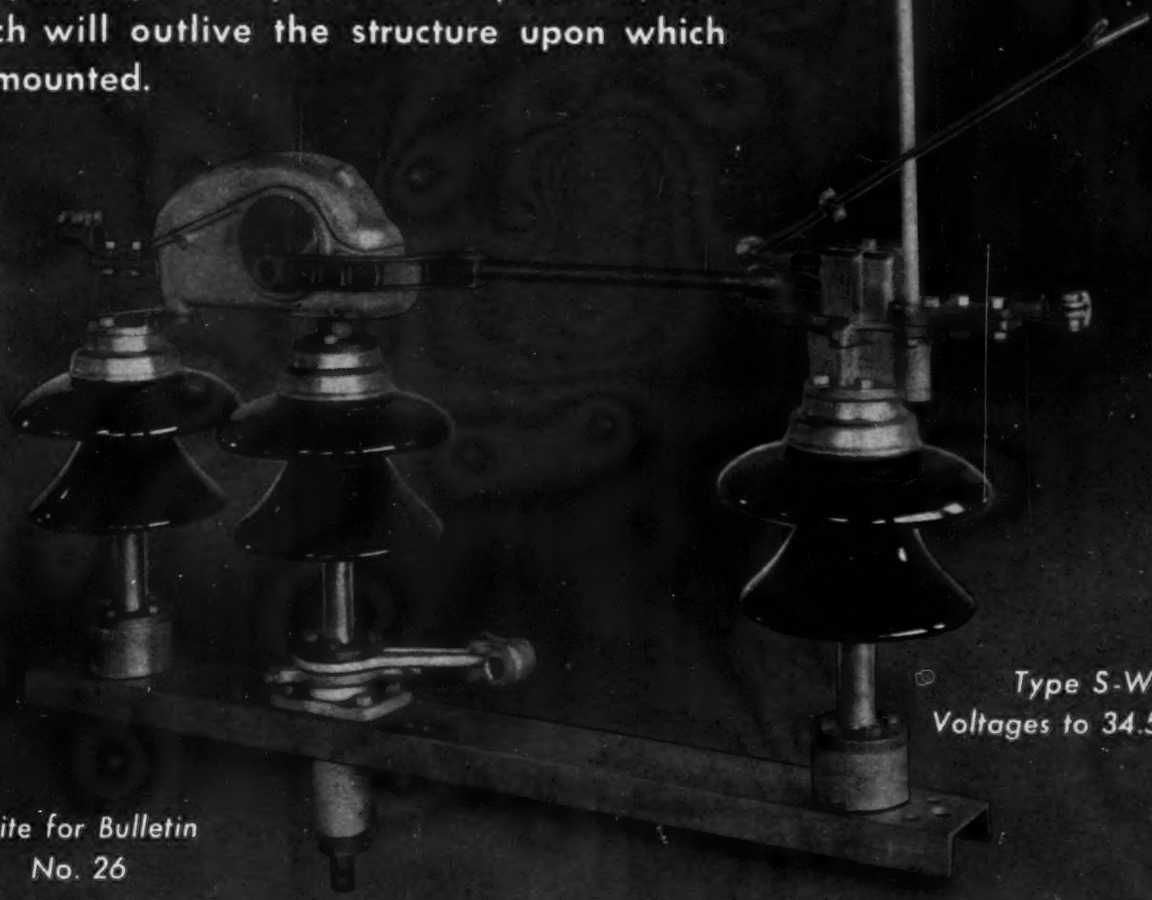
recently at Huntington Lake in Fresno County. A group of Edison executives and other friends of the builder dedicated a tablet in his honor and marking the change of the name of Florence Tunnel to Ward Tunnel. The tablet, on a base of granite, is at the outlet of the tunnel on the eastern shore of Huntington Lake. The tunnel is a vital unit in the company's $150,000,000 Big Creek-San Joaquin River hydro-electric development. the con-

MASTERPIECE
OF TWO
ENGINEERING FIELDS

Electrical and mechanical engineering joined in this Hi-Voltage Switch to produce the one new air break development in 5 years.

The totally enclosed bronze Mechanism is mounted in monel ball bearings and graphite insert bearings.

So dependable and positive in operation, this Switch will outlive the structure upon which it is mounted.



Type S-W
Voltages to 34.5 K. V.

Write for Bulletin
No. 26

HI-VOLTAGE EQUIPMENT CO.

2891 EAST 79TH ST., CLEVELAND, OHIO

struction of which was under Mr. Ward's supervision.

In the Edison Company party were W. C. Mullendore, executive vice-president; R. V. Reppy, Will H. Fischer and D. M. Trott, vice-presidents; Henry M. Robinson, James R. Page and Ben R. Meyer, directors; Dr. G. L. Hoxie, economist; B. F. Fluno, comptroller; B. F. Woodard, assistant general counsel; R. G. Kenyon, advertising manager, and N. B. Hinson, chief engineer.

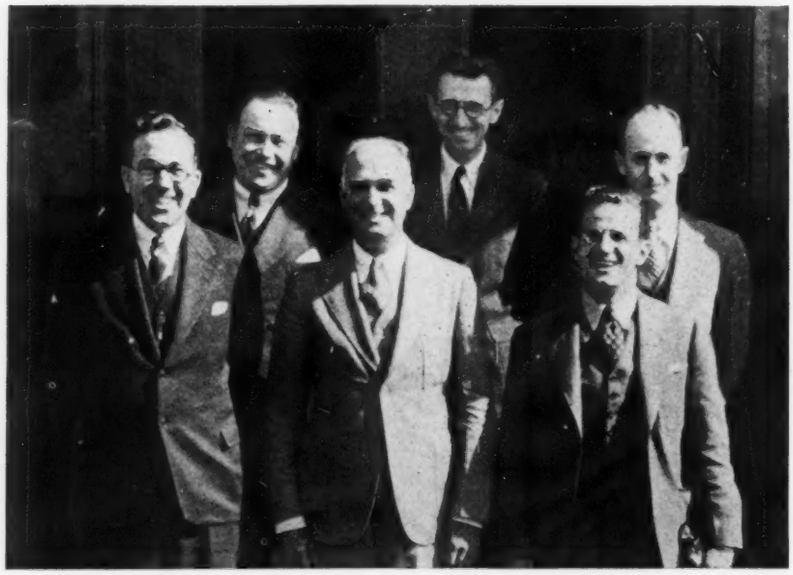
Paying high tribute to Mr. Ward's contribution to the electrical industry, W. C. Mullendore delivered the main address on the dedicatory program. He spoke of the value of the Big Creek enterprise not only as a stabilizing influence in California's electric supply but also as a regulator of water-shed for irrigation, a stimulator of commercial, industrial and agricultural activity through the use of electric power, and a pioneer pattern for hydro-electric development which has been followed in many parts of the world. The improvement of this area by the Edison Company likewise has made available to the public a mountain playground hitherto virtually inaccessible.

Mr. Ward was associated with the Edison company for many years and was president of the organization in 1932 and 1933. He died in 1933.

▶ Frederick Krug, formerly vice-president and general manager of the Porto Rico Railway, Light & Power Company, has been appointed supervisor of southern properties in the Montreal Engineering Company with headquarters at Montreal. The southern properties include: Demerara Electric Company, Ltd., Porto Rico Railway, Light & Power Company, Venezuela Power Company, Ltd., Bolivian Power Company, Ltd., San Salvador Electric Light Company and the Monterey Railway, Light & Power Company. Mr. Krug will supervise the management of these companies.

▶ GEORGE C. EWING, for the past 34 years one of the best-known sales engineers in the Westinghouse Electric & Manufacturing Company's New England organization, was automatically retired on the company annuity plan October 1. Mr. Ewing was graduated from Amherst College in 1890, served as a manufacturer's agent in New York City for two years and, with the exception of an interim during the Spanish-American War, he has been engaged in Westinghouse sales activities in both electric traction and power industry fields. Mr. Ewing will make his headquarters as a manufacturers' agent at 10 High Street, Boston.

CUTLER-HAMMER MEN ATTEND CONFERENCE



Among those who attended the recent five-day conference at the New York factory of Cutler-Hammer, Inc., were (front row, left to right): F. U. Webster, manager merchandising sales; G. S. Crane, vice-president, charge of sales; R. A. Millermaster, apparatus development; rear row (left to right): L. P. Niessen, advertising manager; F. E. Wiese, headquarters sales, and R. A. Davies, apparatus research

OBITUARY

Harry B. Kirkland

Funeral services for Harry B. Kirkland, whose death was announced in ELECTRICAL WORLD October 17, page 13, were held at the Universal Chapel, Lexington Avenue, N. Y. Mr. Kirkland had built up a very wide ac-

quaintanceship in the electrical industry and following the announcement of his death hundreds of tributes were received from all parts of the country testifying to his splendid personal qualities.

Against medical advice he went to his office at N.E.M.A. headquarters a great deal last winter and spring, but in early June he was forced to rest and went to Jackson, N. H., in an endeavor to restore his health. Shortly after his return to New York in September his condition became so serious that he had to be removed to the hospital.

•

▶ JOHN V. ARMSTRONG, 67, secretary of the B. C. Electric Railway Company, Ltd., and resident of Vancouver, B. C., for 46 years, died at his home in that city September 12.

▶ BORIS VASILY NAGASHEV, a noted Russian electrical engineer living at Cambridge, Mass., died September 26 in an automobile accident at West Townsend, Vt., at the age of 32. He was a native of Simbirsk, and after working with noted physicists abroad came to this country in 1926, studying at the Massachusetts Institute of Technology and the Harvard Engineering School and contributing to the development of electric welding equipment

HOW CENTRAL ILLINOIS GAS AND ELECTRIC CO. HANDLES APPLICATIONS AND SERVICE ORDERS

in 1/4 the usual time

WHETHER he phones or comes in, Central Illinois Gas & Electric Company never keeps the customer waiting. In actual experience, their Remington Rand Customer Service Record helps them handle applications to connect or disconnect service in one-quarter the usual time. Errors are reduced at least 98%.

Apart from the ever-increasing necessity to keep customers happy, this simplified Kardex record brings any company many other important benefits. So completely does this record eliminate duplication, many utilities have found it replaces as many as fourteen separate records and files. Writing and filing of applications is eliminated entirely. Positive control is provided over inactive meters, meter-testing, and non-payment cut-offs. Clerical expense is reduced all along the line.

Pays for itself out of direct savings

In most cases inside of one year the direct, tangible savings are sufficient to pay the entire cost of installing the unique Customer Service Record. Remington Rand maintains a staff of experienced professional supervisors to guarantee that your installation is complete and accurate in every detail. As a result, your installation costs are greatly reduced, your personnel expertly selected and trained, your operating procedure organized and manual prepared . . . all without disturbing your present routine.

When it costs nothing to get full details, why not investigate the Customer Service Record now. Simply phone your local Remington Rand office or write Remington Rand, Buffalo, New York.

Ok.. it's from Remington Rand

What Price "Protection"?

What we mean by "protection" is, not the levy taken by gangsters, but the heavy replacement toll that persistently follows the use of ordinary wire under severe conditions. When Rockbestos takes over circuit protection there's no periodic comeback for expenses—the first investment is the last. Costly service outages and replacements are eliminated as effectively as yesterday's public enemies.

How come? Just cut into the insulation of any Rockbestos A.V.C. wire or cable and see how it is made—layers of dense, impregnated, felted asbestos, supplemented by a high dielectric insert—and over all a tough outer braid of asbestos. No wonder it stands up *permanently* under heat, moisture, vibration, oil, grease, fumes and vapors without drying, cracking, rotting or swelling, no matter how long it is in use.

The Rockbestos line includes over fifty types, ranging from fine magnet wire to 2,000,000 C.M. cable and our new 10-D Bulletin describes many of them. Send for it and ask for a sample of the wire you are interested in. Rockbestos Products Corporation, 832 Nicoll St., New Haven, Conn.

Also refer to Electrical World Buyer's Reference Number of Dec. 21, 1935, Vol. II.

Felted asbestos insulation
Asbestos sealed high dielectric insert
Felted asbestos insulation
Outer covering of tough asbestos braid

ROCKBESTOS 600 VOLT A.V.C. POWER CABLE

For use around ashpits, furnaces, ovens, boiler rooms and general "hot-spot" wiring.

ROCKBESTOS A.V.C.

the wire with permanent insulation

for high-speed service and to amplifier design. For a time he was connected with the General Electric research laboratory at Lynn, Mass.

J. RANDOLPH COOLIDGE, president of the Montan Treating Company, Boston, Mass., and a prominent figure in the wood preserving industry since his graduation from the Harvard School of Forestry, died at Center Sandwich, N. H., September 23, at the age of 49.

▶ WORTHINGTON CORNELL, an electrical engineer connected with the Stone & Webster organization at Boston, Mass., for the past 38 years and recently identified with the insurance interests of that house in relation to utilities under its management, died at his home in Malden, Mass., September 28 at the age of 59. He was a graduate of the Massachusetts Institute of Technology and was an authority on utility statistical analysis.

▶ Frank H. Burtt, aged 58, for nearly a quarter century a specialty salesman in the industrial and central station fields with the Wetmore-Savage Electrical Supply Company, Boston, Mass., died recently at his home in Wellesley, Mass. He was formerly connected with the motor sales field service of the Century Electric Company and was highly regarded throughout New England.

▶ Austin E. Carpenter, for some years prominent in electric road truck sales at Boston, Mass., on behalf of the General Vehicle Company, died at his home in Winthrop, Mass., October 11 at the age of 66.

GEORGE W. COOPER, who has been connected with the sales organization of the Ohio Brass Company since 1906, died September 14. During his long career with O-B Mr. Cooper's efforts were devoted to all phases of the company's business. In recent years his headquarters have been at the New York office of the company.

▶ JAMES FAGAN, an electrical engineer and an associate of the late Thomas Edison during his experiments at the Menlo Park laboratories, died September 22 at his home in Elizabeth, N. J., following a short illness. He was 79 years old. Mr. Fagan retired in 1929. He was a graduate of Stevens Institute of Technology.

NOVEMBER 3, 1936
Air Conditioning Continues to Surge Ahead
More and more, replacement business as well as new residential construction is calling for air conditioning. The upward trend in commercial units is almost phenomenal. The main reason is obvious: Both, residences and commercial quarters can be effectively air conditioned all year
POWER OUTPUT REACHES NEW HIGH MARK
As the operations of central station plants rise toward the winter peak, each week's reports show that the lead over corresponding periods of all earlier years is being fully maintained. Also, except as affected by holidays, each week's production is establishing a new all-time record with almost monotonous regularity.
During the week ended Septem
19 the energy
Institute. This was 17.2 per cent higher than in the like week of 1935 and 21 per cent above 1929. It overshot the previous maximum, attained only three weeks earlier, by 35,000,000 kw.-hr. In the South the gain over 1935 continues around 23 per cent and
Year
Aug. 29
Week
+13.7
16.

Rising Loads Need Modern Meters

Today's headlines of rising loads are a definite indication of an urgent need for modern meters. Among these are the new loads created by commercial air conditioning. For the correct metering of these new or similiar loads, a modern Sangamo Meter is available.

The Sangamo Type L-2 Two-Element Meter, in which two complete electro-magnetic elements drive a single disk, may be used on services either from network or other polyphase circuits. Designed for modern "A" and "S" mountings, these meters combine convenience in installation with a minimum of space and cost requirements.

Sangamo Type L-2-A, Two Element, Single-Disk Watthour Meter in "A" Base.

Sangamo Type L-2-S, Two-Element, Single-Disk Watthour Meter in Socket Mounting.

BULLETIN No. 91 CONTAINS THE DETAILED DESCRIPTION.

SANGAMO ELECTRIC COMPANY
SPRINGFIELD, ILLINOIS

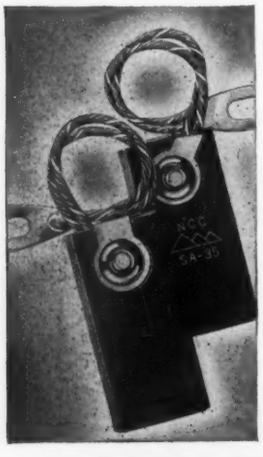
They must be

UNIFORM

"Uniform Texture is not Enough"

● Uniform performance is the final measure of brush uniformity. This is achieved in "SA" Series grades.

Intensive research in the National Carbon Company laboratories has disclosed the basic physical properties responsible for satisfactory brush performance. It has also determined the combinations of materials and the methods of manufacture which impart these properties, in uniformly controlled degree, to the brush material.



These are the reasons for the uniform performance experienced by the many users of "SA" Series brushes. These grades possess, in accurate measure, those characteristics which directly contribute to satisfactory and uniform performance on commutating equipment.

●

An "SA" Series grade is not "just another brush." It is an engineering achievement.

PROVE THIS YOURSELF BY A TRIAL

NATIONAL CARBON COMPANY, INC.
Carbon Sales Division, Cleveland, Ohio
Unit of Union Carbide UCC and Carbon Corporation
Branch Sales Offices: New York Pittsburgh Chicago San Francisco

Telling and Selling

[*Continued from page 79*]

tions all over the country. You electric people of this great Hoosier state are to be congratulated for keeping your state association alive and active. You show courage, wisdom and foresight. I hope for the reorganization of a number of the geographical divisions and state associations, on an active, efficient and useful basis.

The electric industry has done nothing for which it must bend its knee in humble apology. True, there have been some who erred; some who wronged, but what industry or what profession has been without its share of wrongdoers? I do not exclude the "political profession," either. With more than a half century of service to our fellow men, our industry can place its record of accomplishment beside that of any other industry, or any sub-division of government, for honesty, performance and sincere service—and feel justly proud.

But this is no time to meditate. This is a time to act! We have a big job to do. We should continue our sales efforts, building greater load, resulting in new opportunities to serve our customers, and greater protection for the investments of our 10,000,000 security owners, and we must unite to protect our industry against the onslaughts of unfair political attacks and unreasonable governmental interference.

Our theme song for next year

In carrying on, let's make Co-operative Enlightenment our 1937 theme song.

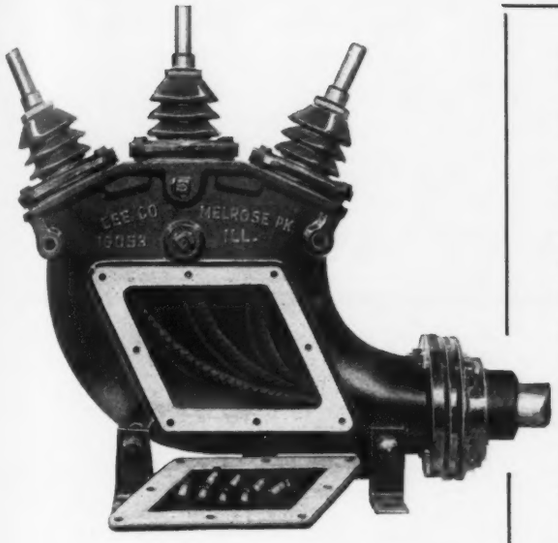
Let's co-operate with every selling agency in the territories we serve, to create sales of every type of electrical appliance and equipment, thereby making for greater use of our service, and consequent benefit to our customers.

Let's enthusiastically participate in every one of the co-operative endeavors that will be presented by the national sales committee of our institute.

Let's co-operate, intelligently and consistently, in educating our employees and our stockholders so that they can crush falsehoods with truth.

Let's carry on today, tomorrow and every day a program of co-operative enlightenment, so that the public will have even greater respect for us, and greater confidence in us.

That's our job! Let's do it!



IMPROVED "THREE E" OUTDOOR CAPNUT STYLE CABLE END BELLS

for greater dependability and protection

Among the features that make these Cable End Bells important considerations in your plans for greater economy, are the following: 1. Absolutely oil and compound tight. 2. One piece wet process porcelain bushings. 3. Unit bushing construction. 4. Oil resisting gaskets. 5. Higher dielectric strength. 6. Improved types of cable entrances.

NOTE removable cover plate on body.

This feature is of great advantage during installation of bell, for inspection and when making changes.

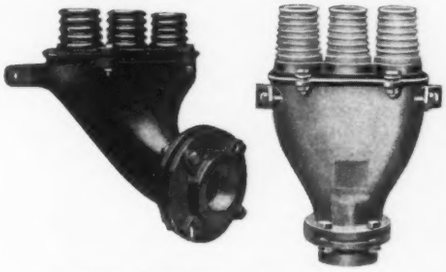
Made in a wide variety of shapes and sizes.

Write for Bulletin No. 501.

NEW "THREE E" DESIGN FEATURES LOWER INSTALLATION AND MAINTENANCE COSTS

. . . assure greater safety, and increase service life

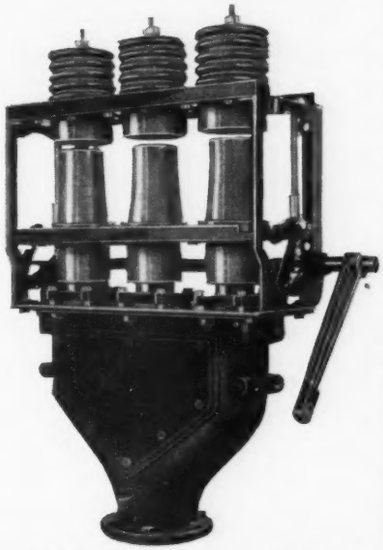
INDOOR CABLE END BELLS



OPEN BUSHING STYLE

Bell body is of sufficient cross section to assure mechanical strength and of ample size to give proper clearances. The porcelain bushings have greater flashover value. Improved cable entrances mean easier and better installations. Made with a larger variety of cable entrances. Detachable mounting lugs to permit different styles of mountings. "Three E" now offers a larger variety of shapes than ever before. Many styles and sizes available. Send for Bulletin No. 502.

"THREE E" TELESCOPING ISOLATORS



"THREE E" makes a complete line of switching equipment, bus supports, and miscellaneous wiring devices, backed by 25 years of sound, practical, and advanced engineering. Write for catalog.

"Three E" Cable Isolators for all services.

New, safe, compact device for terminating and disconnecting lead covered power cables.

All live parts of the cable isolator are enclosed in insulation when in either closed or open position. Danger of accidental contact by operators or workmen is eliminated. They operate equally well in any required position—compactness means minimum space—you make savings in mounting structure.

From the illustration it will readily be seen that the use of the cable isolator gives a disconnecting type cable and bell, and furthermore, a gang operated disconnecting cable end bell wherein the circuit is opened or closed with one operation, and no dummy caps or tubes, which add additional complications are necessary. Send for Bulletin No. 131.

ELECTRICAL ENGINEERS EQUIPMENT CO.
MELROSE PARK, ILL.

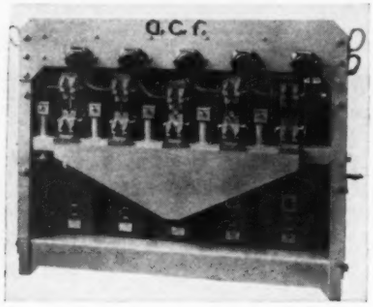
"THREE E"

HIGH QUALITY LINE AND STATION EQUIPMENT

New EQUIPMENT AVAILABLE

Electric Metal Slug Heater

Photo-electric cells and an automatic kicking-out device insure that metal slugs will be heated and removed from this electric heater at the exact temperature for



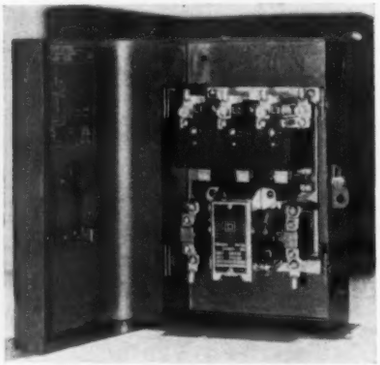
Berwick electric metal slug heater, type "CS"; other horizontal heaters, similarly built and equipped, heat any diameter of stock from ¼ to 3 in. in diameter, and are adjustable for any length heat, at any point on the bar, from 1 to 24 in. **American Car Foundry Co.**, New York, N. Y.

which the photo-cell tube has been set. It is also claimed that adjustments may be made easily and quickly and that overheating or underheating the slugs is impossible. Jaws of the heater have a vertical movement.

•

A.C. Automatic Starter

This line voltage type of automatic starters, for remote operation, may be used to start polyphase squirrel-cage motors directly across the line, at full voltage where the application permits. Accessibility for periodic inspection, arrangement of parts for quick replacement, vertical closing action and compactness are major features. Used with a three-wire push-button station, it provides low-voltage protection. When the voltage fails the contactors open and the motor stops. The motor will not start until the start button is pressed. Used with a two-wire control, this control provides low-voltage release. Two or more push-button stations, limit switches or other mechanisms may be used with one unit and motor, and liquid level, pressure or heat regulating devices may be applied with the starter for automatic motor control.



Type T, Class 8536 line voltage a.c. automatic starters; available for polyphase motors from 7½ hp. at 110 volts to 25 hp. at 440, 550 and 600 volts, for single-phase motors from 3 hp. at 110 volts to 7½ hp. at 220 volts; dimensions of mechanism, 9-3/16 x 5¾ x 4½ in. **Square D Co.**, Milwaukee, Wis.

•

Permanent Meter Chart

"Permochart" for all types of recording meters. **Permochart Corp.**, New York, N. Y.

A permanent chart for use on all recording meters is available which has a smooth, hard surface that will permit pen recordings to be washed off with a dampened cloth. It was developed especially for use on daily controls, where the chart is removed at the end of the day and discarded, and is not designed to replace charts retained for future reference. No meter changes are necessary for its use; same pen and ink employed on the chart in use may be used on this chart. Tests have demonstrated that a chart can be kept in daily use in excess of three years under normal operating conditions.

•

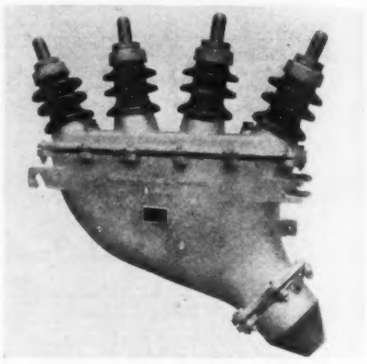
Portable Arc Welder

Noel "Speedarc" welders; dual control systems; in 125, 200, 300, 400 amp. sizes; unity power factor at no load, leading power factor up to 40 per cent at full load claimed; efficiency of 300 amp. size said to be 58 per cent at 25-volt operation, 68 per cent at 40-volt operation. **Ideal Electric & Manufacturing Co.**, Mansfield, Ohio.

According to tests, these welders have a recovery time, from short circuit to normal welding current, of less than ¾ of a cycle of a 60-cycle timing wave. This is said to assure sufficient voltage to maintain the arc and to eliminate the necessity of restriking the arc. It is also claimed that the short-circuit current surge, produced when the electrode is touched to the work to "strike" the arc, is low, and that the welder changes from zero to maximum surge current and back again so quickly that the electrode does not heat up. Thus the tendency of the electrode to "stick" is overcome. In addition, the machine is said to be the only welder that will maintain its voltage and current settings when started up "cold" and run at full load for any desired period.

Pothead

Cap nut and cover gaskets of this cable terminator, designed particularly for crossarm mounting in distribution service, are confined in a recess, protected against the



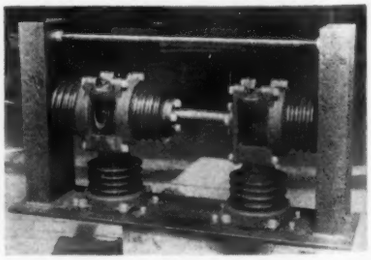
Pothead; for 7,500-volt, 500-amp. cable; porcelain bushings, bronze cover, hot-galvanized body. **Delta-Star Electric Co.**, Chicago, Ill.

weather. Cap nut compresses its gasket a definite amount and then makes direct electrical contact with the bronze cap cemented to the porcelain bushings. This construction is said to reduce considerably the current carried from stud connector to cap nut. Vertical soldering holes in stud connector insure easy soldering. Insulated conductors may be brought through the top caps for measurement, prior to cutting and skinning.

•

Bus Support

This heavy-duty bus support is one of a recently developed line. The line includes supports for bar and aluminum channels and the supports are made up to support one, two or three buses within a single frame.



Heavy-duty bus support; dimensions, about 4 x 2 ft. 6 in.; weight, approximately 50 lb.; made for any size busbar and also for aluminum channels up to 12 in. **Railway & Industrial Engineering Co.**, Greensburg, Pa.

ELPECO'S

Contribution to Heavy Capacity Bus Isolation

WIDELY USED IN

Industrial Plants
Mines
Railroads
Utilities

THE term "NO HEATING" aptly describes this Elpeco development, for when it is in closed position with lock properly adjusted, it is capable of carrying the maximum current of the bar with the same temperature rise.

This is easy to understand when you consider that a pressure of 25 lb. on the pressure lock handle exerts a total pressure on the contacts of 3000 lb. on the smaller switches to 7000 lb. on the larger ones.

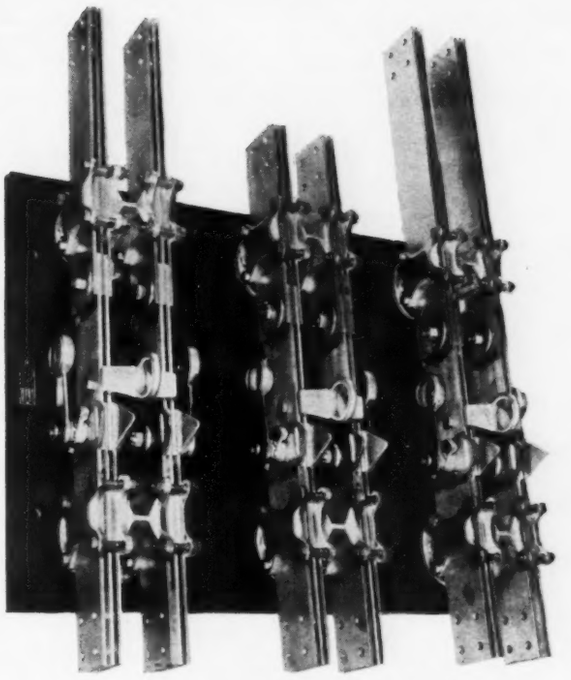
When the "screw-jack" lock is released, a slight pull is sufficient to open the switch, varying from a 10-lb. pull to 25 lb. on the large size.

It is made for any number and size of bars—to fit your existing bus bar installation.

When desired a locking handle can be substituted for the hinge contact—effecting a double lock per bus.

No finer switch can be produced for this service—and no lesser switch is safe.

ELECTRIC POWER EQUIPMENT CORPORATION
ELPECO
PHILADELPHIA, PA.

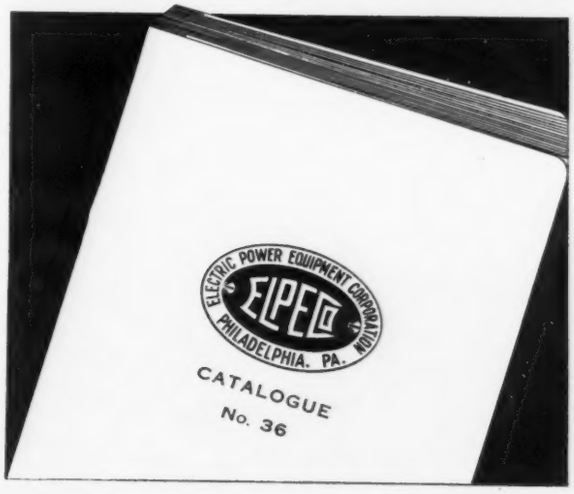


HERE'S ANOTHER ELPECO
HIGH QUALITY PRODUCT

Typical 4000 amp — 5000 volt — 3-pole indoor bus sectionalizing disconnect mounted on ebony asbestos panel installed in the plant of a manufacturer of streamlined trains . . . MODERN.

ALSO MADE FOR 7,500
15,000
25,000
35,000 VOLTS.

ELPECO'S NEW CATALOG



FOR YOUR CONVENIENCE

Electric Power Equipment Corp.
412 North 18th St., Philadelphia

Please send your new complete catalog to the following address:

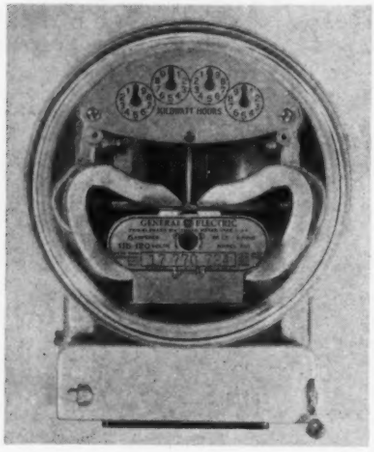
Name.....

Company.....

Address.....

Watt-Hour Meter

Announcement has been made of a two-element, single-disk, watt-hour meter that is said to be comparable in size and weight with a single-element meter. A new type of disk construction is designed to prevent interference between the elements.



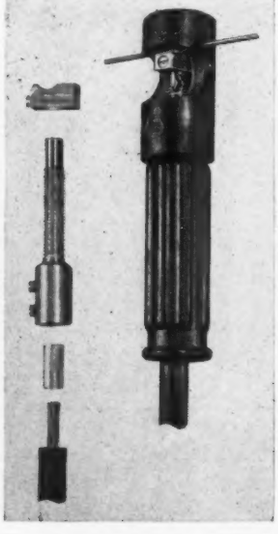
Type V-2A, two-element, single-disk, watt-hour meter, for wall or connection-box mounting; available also in type V2S for socket mounting; compensated for temperature errors. **General Electric Co.,** Schenectady, N. Y.

The disk is composed of five insulated laminations, each lamination with five radial, staggered slots. This construction confines eddy currents in the disk to the vicinity of the element producing them. It is claimed the meter will register energy consumption up to 300 per cent of normal load current at both unity and one-half power factor with high degree of accurracy.

•

Insulated Jumper Clamp

This insulated jumped clamp may be used in by-passing primary cutouts, cutting over lines on junction poles and making temporary connections in storm trouble, or alterations and additions in substations. It consists of four parts—contact jaw, spindle screw, sleeve for soldering, and a handle of corrugated, medium-hard rubber. The sleeve is soldered to the end of the jumper cable and retained by the setscrew on the spindle, which, in turn, is screwed in the handle.

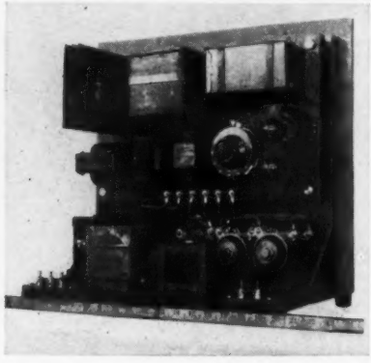


Insulated jumper clamp; one size; main line contact accommodates wire from No. 10 solid copper to 750,000 circ. mil stranded copper; jumper contact, from No. 10 solid to No. 4/0 stranded. **Tips Tool Co., Inc.,** Taylorville, Ill.

•

Booster Voltage Regulator

A booster voltage regulator that introduces no appreciable distortion in wave form is said to be admirably suited for laboratories, in meter standardization or calibration work, or for holding the voltage of battery chargers constant. The device has three main divisions. One of these, a voltage sensitive network, translates small line voltage changes to relatively large changes of output current. This increase in current is rectified and impressed on the d.c. or saturating winding of the saturable core reactor. The reactor then feeds the primary of a booster transformer which introduces a boost into the line.



Type REF regulator; for 2½ kva; available also in sizes for 5 and 7½-kva. loads; single-phase, 120- or 240-volt types, to regulate a decrease in line voltage up to and including 10 per cent of line voltage. **Roller-Smith Co.,** New York, N. Y.

•

Stress-Relieving Heater

An electric heater, designed to relieve the internal stresses set up in the welded joint of a pipe has been developed recently. It is arranged in three sections which are intended to be clamped around the pipe to form a complete circular unit. The joint is brought up to a certain temperature, "soaked" at that temperature and then cooled at a definite rate. With the heater is furnished a portable automatic control panel for the regulation and control of the temperature during the stress relieving and cooling. Holes are provided in the heater for the insertion of thermo-couples. The heater has a heating face of 22 in. to insure uniform stress-relieving temperature in the pipe for a distance of six times the pipe thickness on either side of the weld.

"Falcon" heater, suitable for pipe sizes 8 to 12 in diameter, with a maximum thickness of 1¼ in.; capacity, 27 kw.; for use on three-phase, 220- or 440-volt service. **H. O. Swoboda, Inc.,** Pittsburgh, Pa.

ENGINEERING DATA FROM MANUFACTURERS

Bulletins and catalogs now available to engineers by manufacturers and associations

FARM WIRING—"The Farm Wiring Problem," a newly published 28-page booklet, is available from the General Electric Appliance and Merchandising Department, Bridgeport, Conn. This booklet gives the full text of a talk delivered at the 30th annual meeting of the American Society of Agricultural Engineers, with respect to what constitutes adequate wiring for farms, and also contains information on the methods of estimating costs, specifications and lists of equipment needed. Bulletin GEA-2421 contains information on the structural features, dimensions and catalog data of high-efficiency transformers for rural-line service.

PUMP BULLETINS—Dimensions, mechanical features of and applications for various types of pumps and air compressors are furnished by a series of bulletins offered by the Worthington Pump & Machinery Corporation, Harrison, N. J. These bulletins and their subjects: W-318-B5A, two-stage volute centrifugal pumps; W-621-B1A, single, direct-acting, air-cooled air compressors; W-112-B4, horizontal, duplex, direct-acting, Underwriter fire pumps; W-102-B1A, turret-type, horizontal, duplex-piston pumps for handling liquids up to 200 lb. per sq.in.; W-350-B1, centrifugal acid pumps, low duty series; W-621-B7C and W-620-B7E, air compressor units; W-101-B6, horizontal, duplex, steam pump and receiver sets; L-711-B2, horizontal, single- and two-stage, dry vacuum pumps; W-319-B1, centrifugal boiler feed pumps; W-321-B9, "Monobloc" centrifugal pumps for heads up to 250 feet; L-700-B1A, single- and two-stage vertical vacuum pumps; W-321-B10, "Monobloc" centrifugal pumps for bulk loading stations and distributing systems; W-101-B3A, horizontal, duplex-piston pumps for handling liquids up to 150 lb. per sq.in.; W-310-B5, pressed steel frame-mounted centrifugal pumps; and W-101-B4B, horizontal, duplex-piston pumps for handling liquids up to 350 lb. per sq.in.

GAS AND STEAM ENGINES—Specifications, mechanical details, dimensions and typical installations of vertical four-cycle engines are given in Bulletin S-550-B4B, issued by the Worthington Pump & Machinery Corporation, Harrison, N. J. Similar information on single, horizontal steam engines is contained in Bulletin S-575-B1 of the same company.

THERMOCOUPLE PYROMETERS — Catalog N-33A, issued by the Leeds & Northrup Company, 4902 Stenton Avenue, Philadelphia, Pa., discusses this line of thermocouple pyrometers. This potentiometer method of measurement is explained, and the complete line of instruments is illustrated and described to enable the user to select the proper instrument to indicate, signal, record or perform a number of functions in addition to indicating temperature.

COPPER BUSES—Copper buses of various shapes, including flat bars, tubes, channels, angles and cables, are discussed in Publication C-25 of the Anaconda Wire & Cable Company, 25 Broadway, New York, N. Y. The 20-page booklet contains performance data on various types of bus arrangements, analyzed by means of curves, tables and illustrations.

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Recent Rate Changes

MICHIGAN PUBLIC UTILITIES COMMISSION closed its hearing last week on rate schedules of the Detroit Edison Company and took the two days' testimony under advisement. William M. Smith, commission chairman, indicated an order covering its findings would be issued this month. Harry A. Snow, Edison controller, ended the testimony with a suggested block rate system for residential subscribers. The suggested system was an outgrowth of a conference between commission and Edison engineers. It would gradually supplant the present system of clients on a basis of the number of rooms serviced. Mr. Snow said if the suggested system were used and the figures he used to illustrate it were adopted, the result probably would be a 5 per cent cut in the bills of resident subscribers. Alex Dow, president of Detroit Edison, testified that in the future three factors would be outstanding in maintaining rates. They were: Increased federal taxation, the raised cost of living coupled with impending social security levies, and increase in coal prices. Mr. Dow told the commission he felt confident the public would demand expanded service and provide additional markets for electricity. He urged that a uniform rate schedule be maintained for his company which serves a heavily populated area in southeastern Michigan and a thinly populated section in the east-central district. The utility president indicated, but did not say definitely, that he was ready to compromise with the commission. He declared his objectives were to simplify his company's rate schedules and arrange for all electricity for one client to be measured by one meter. Mr. Dow said he did not agree with the courts that reproduction cost new of his company would be a sound basis for establishing a rate of return for the firm, and that he did not believe accountants could figure future depreciation over long periods.

INDIANAPOLIS POWER & LIGHT COMPANY proposed to reduce electric rates $412,167 annually on basis of present consumption at the first of a series of conferences between city officials, the public counsellor and the Public Service Commission. The revised rates would apply to residential, commercial and power consumers including city, suburban and rural patrons. Under the proposed schedule city residential consumer's bill would be $4.77 for 100 kw-hr., a reduction of 98 cents from $5.75, which the same amount costs now. The minimum monthly bill was retained at 65 cents under the company proposal.

LAWRENCE GAS & ELECTRIC COMPANY has been ordered by the Massachusetts Public Utilities Commission to reduce its electric rates annually $190,000, effective November 1.

CENTRAL ILLINOIS PUBLIC SERVICE COMPANY has been ordered by the state Commerce Commission to reduce its electric rates to effect an annual estimated saving of $156,000 to consumers in central and southern Illinois.

DES MOINES ELECTRIC LIGHT COMPANY has offered to reduce its gas and electric rates from 5 per cent upward to all retail users and the proposal was recently given its first reading in an ordinance by the Des Moines City Council. The total annual reduction in rates would be $161,000, of which $113,700 would be in electric rates. If the Council passes the ordinance the new rates would affect all gas and electric bills from the first meter readings after October 15.

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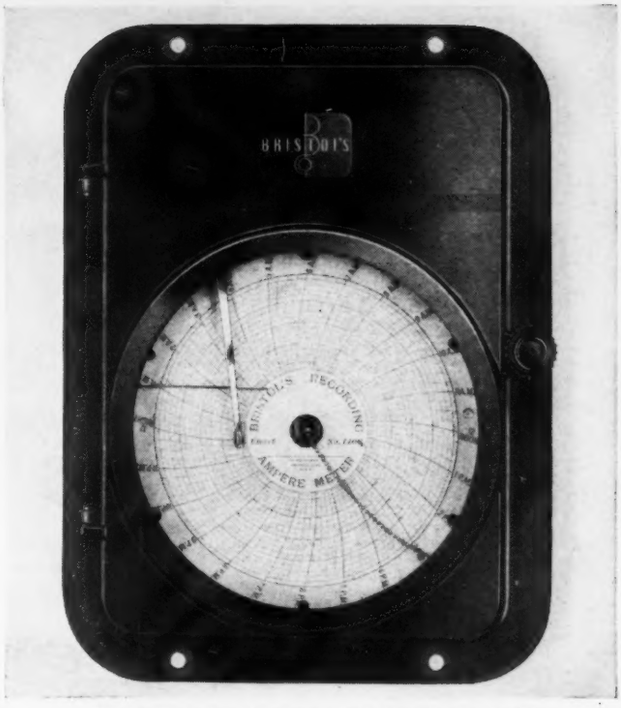
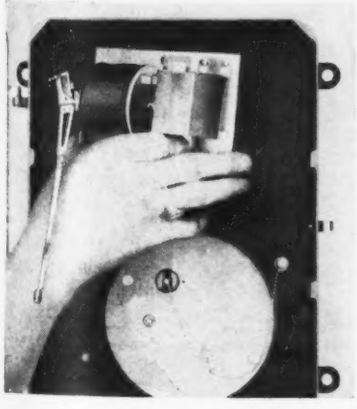
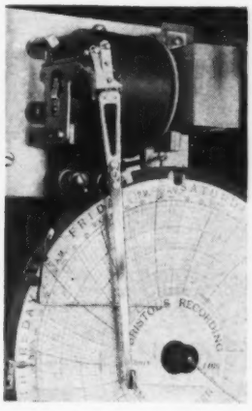
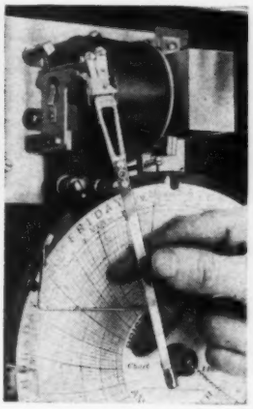
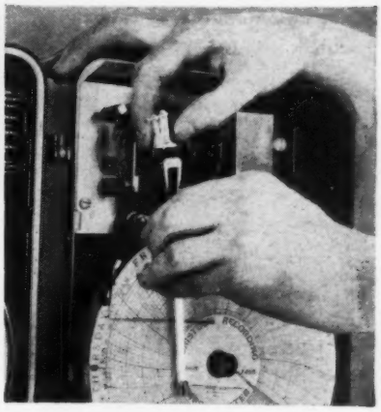


Bristol's Recording Ammeter, Single Pen, Model 640M.









LEFT: Movement interchangeable. Just remove three screws, take out the old movement, and put in a new one—for the same or a different range. *CENTER:* Pen arm is pivoted at the top. Delicately controlled by gravity, the pressure of the pen against the chart is constant—even though the pen arm becomes bent. *RIGHT:* Pen arm removed easily, quickly.

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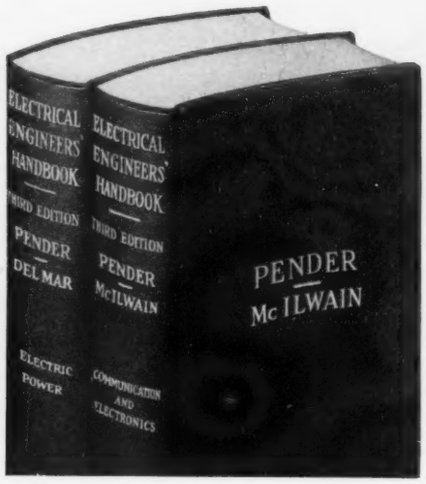

PENDER'S

ELECTRICAL ENGINEERS' HANDBOOK

Third Revised Edition

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WILLIAM A. DEL MAR, A.C.G.I., *Associate Editor-in-Chief*
KNOX McILWAIN, B.S., E.E., *Associate Editor-in-Chief*

The third edition of the famous Pender "Electrical Engineers' Handbook" appears in a totally different form than heretofore. Its efficiency and usefulness have been increased by the separation of its content into two independent, inclusive volumes, listed as Volumes IV and V of the new Wiley Engineering Handbook Series and dealing with **Electric Power** and **Communication and Electronics**, respectively. As was the case in Volume I of the Series, the "Handbook of Engineering Fundamentals," recently published under the editorship of O. W. Eshbach, the new "Pender" is set up in a larger format, with a trimmed page measuring 5½" by 8⅜", allowing the use of larger, clearer type and more readable illustrations and diagrams. The encyclopedic arrangement used in the early editions of this handbook has been abandoned. It has been the aim of the editors in preparing these two volumes to make each one cover thoroughly the particular field to which it is devoted. Together they form a veritable library of information embracing the entire field of electrical engineering.

The **Electric Power** volume has been consolidated into nineteen sections, each dealing with a general topic, the treatment accorded each topic being handled so that each receives attention commensurate with its importance in relation to other subjects in the field. New topics, such as Air-conditioning, Electric Water-heating and Electricity in Agriculture, have been included, and topics of newly developed importance, such as Automotive Electrical Engineering and Industrial Applications of Motors, receive correspondingly greater prominence. Power Transmission and Distribution receives a large amount of space. Thirty-seven eminent engineers collaborated with the editors in the preparation of this volume.

Communication and Electronics covers the whole field of communication as a unit; it includes telegraphy, telephony, radio broadcasting, point-to-point radio telephony, facsimile transmission and reception, public address systems, sound motion pictures, aviation radio, and television. It gives complete information on electronic control systems, full data on the design of all parts of the system, over sixty-five pages of acoustic information, complete mathematical tables, and many other important data. Forty-seven specialists contributed to this volume.

The outstanding contribution which the new "Pender" makes is the fact that no longer need the electrical engineer purchase a book containing much material of no direct use to him. The communication engineer may purchase only the volume covering this field; the power engineer likewise will probably want only the volume covering his particular interest. Thus each will secure the one volume essential to his work, and at a lower unit cost. Furthermore, he will find a greater amount of space devoted to each topic than was possible heretofore.

Electric Power: 1300 pages; 709 illus.; 5⅝ x 8⅝; $6.00

Electric Communication and Electronics: 1022 pages; 981 illus.; 5⅝ x 8⅝; $5.00

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Municipal Plants

SEAFORD, DEL.—Petition, sponsored by the Eastern Shore Public Service Company and signed by 32 Seaford property owners, has been presented to the Court of Chancery requesting it to invalidate the franchise recently granted by City Council to the Seaford Light & Power Company which plans to build a plant in Seaford (ELECTRICAL WORLD, September 26, page 94).

OGDEN, UTAH.—City commission, by a 2 to 1 vote, has authorized Mayor Harman W. Peery to offer the Utah Light & Traction and the Utah Power & Light Company $700,000 for the electrical power distribution system now operated by those companies within the Ogden city limits.

STROMSBURG, NEB.—A special three-judge court sitting at Osceola recently approved the city's offer to pay the Iowa-Nebraska Light & Power Company $53,046 for its distribution system. The offer was filed with the court in the form of an agreement between the two parties. Last April residents voted to take over the system and District Judges Louis Lightner of Columbus, H. L. Blackledge of Hastings and E. C. Kroger of Grand Island were appointed to fix the amount.

BAYARD, NEB. — Representatives from Minatare, Melbeta, McGrew, Bayard, Bridgeport and Broadwater organized the western Nebraska public power district and have made plans to build transmission lines to their communities from the U. S. Bureau of Reclamation lines. Former Attorney General C. A. Sorensen was employed to perfect the organization and file an application for a loan from the R.E.A.

EAST LIVERPOOL, OHIO.—Petitions bearing approximately 1,500 signatures, more than double the required 642, have been filed calling a referendum on councilmanic legislation authorizing construction of a $1,500,000 municipal power plant.

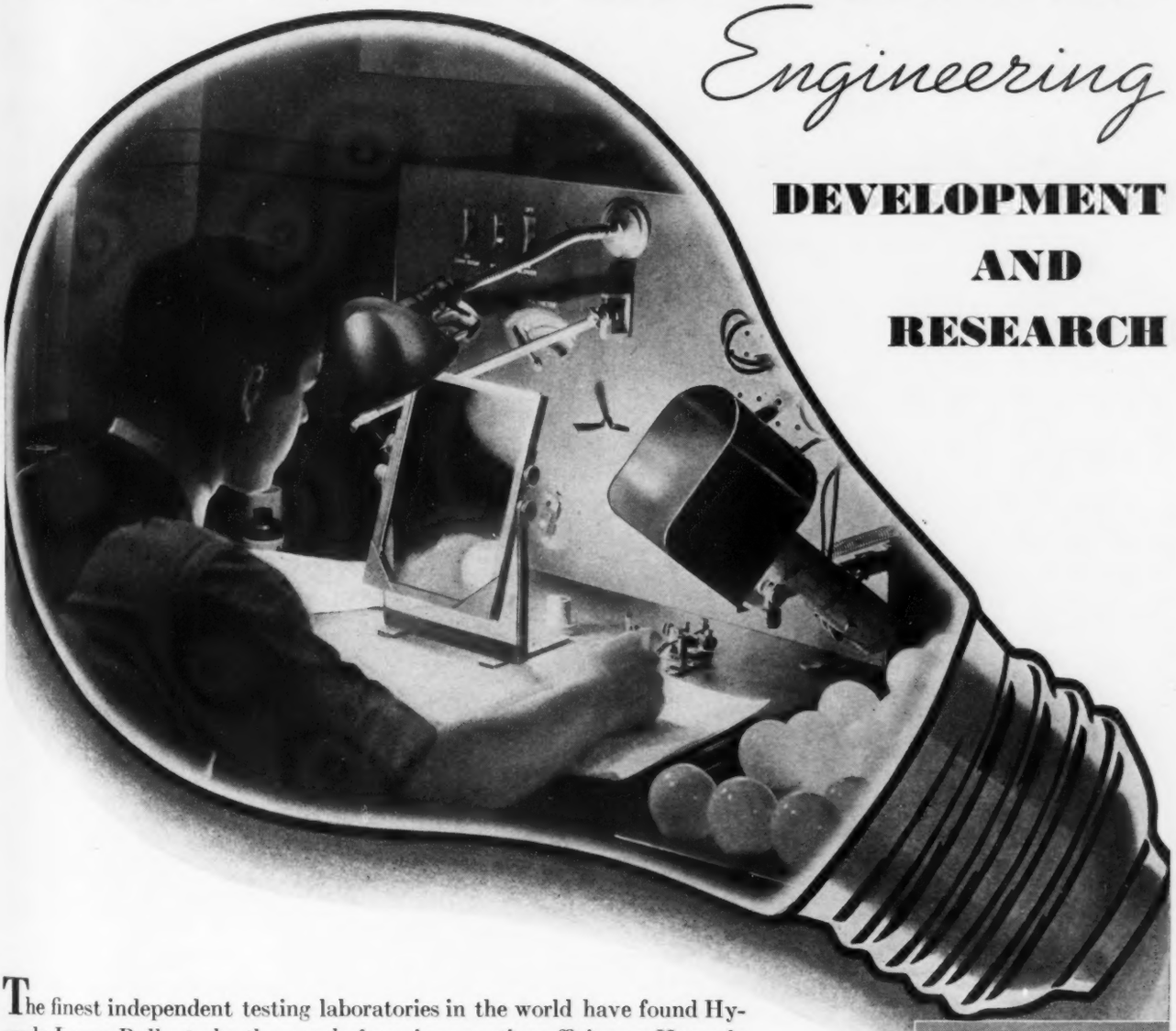
OREGON.—In spite of not-too-optimistic reports on the formation of people's utility districts issued last summer by the State Hydro-Electric Commission, two of these districts will be brought before the voters at the November election. Sponsors of the districts in Linn and Marion counties, were successful in securing the necessary signatures on final petitions to place the proposals on the ballot. Petitions for both these districts were filed with the Hydro-Electric Commission on September 8.

COLUMBIA, TENN.—Although this city on September 1 voted $300,000 in bonds for a municipal light and power plant and distribution system the project has been postponed indefinitely due to court injunctions obtained by opponents.

NEWBERN, TENN. — Tennessee Public Works Administration was notified September 8 by Mayor B. F. Grisham that in the election held there in early September to determine whether the town should build an electrical distribution system for use of T.V.A. power, 351 votes were cast in favor and but one against. The town has an application with the P.W.A. for a grant to cover 45 per cent of the cost of the project, which has been estimated at $105.455. The application has received approval at state and national offices.

BAY CITY, TEX.—Plans and specifications for a proposed municipal electric light and power plant are being drawn by the Garrett Engineering Company of Houston. The proposed plant will cost $225,000. The city is negotiating for the purchase of electric

$400,000 A YEAR FOR LAMP AND RADIO TUBE *Engineering* DEVELOPMENT AND RESEARCH



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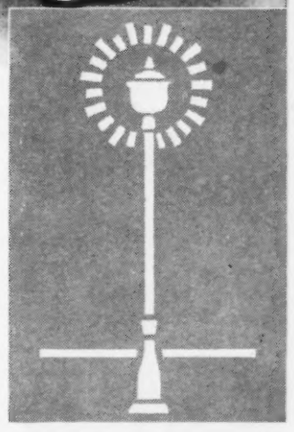

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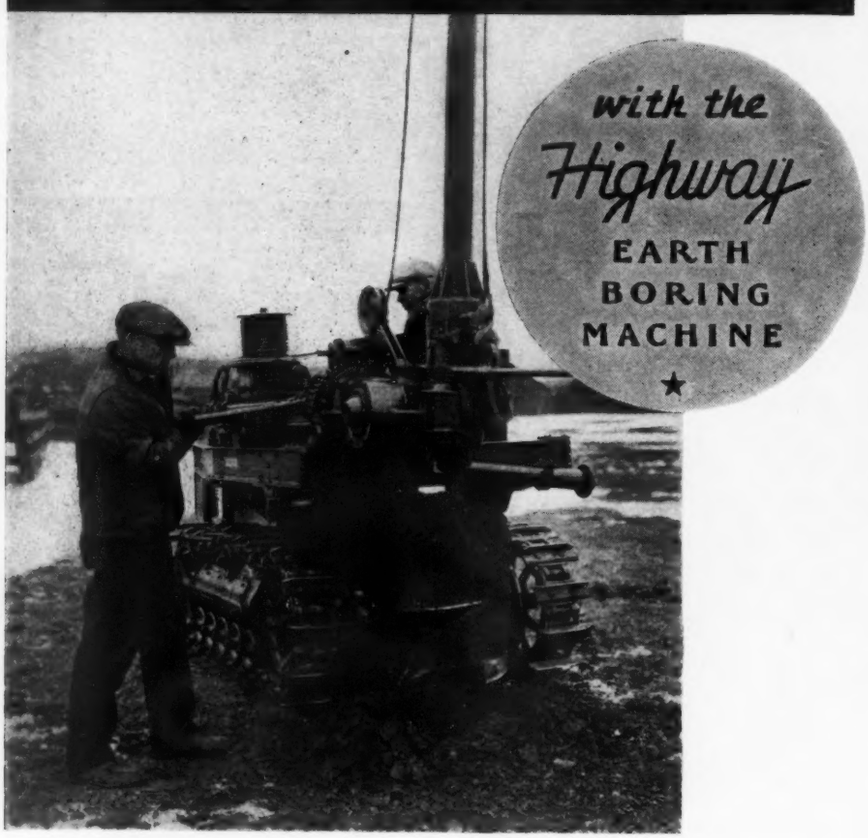

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distributing system owned by the Central Power & Light Company, whose franchise expires in 1938.

SEATTLE, WASH.—Domestic lighting rate for Seattle was reduced 10 per cent about October 1 as recommended recently by City Light Superintendent J. D. Ross. The move was assured when the city council utilities committee, comprising a council majority, endorsed the Ross proposal and ordered the rate reducing measure for early introduction in the council. Eighty thousand domestic customers will share in the $13,600 a month reduction. Under the new schedule, the basic rates will be cut from 5 cents to 4½ cents on the first 40 kw.-hr. used each month. A similar reduction was made about a year ago. This led to increased electrical consumption sufficient to bring City Light's income back to the figure earned under the 5½ cent rate.

CORBIN, KY.—City officials have decided to postpone the floating of a $100,000 bond issue for improving the city electric plant (ELECTRICAL WORLD, Sept. 12, page 118).

AYR, NEB.—Attorneys for the Southern Nebraska Power Company have given notice of intention to challenge in U. S. Supreme Court the constitutionality of a Nebraska statute governing elections at which voters decide whether or not they wish to sell their municipal plant to a private company. They asked the Nebraska Supreme Court to withhold the mandate in the case of the state against the company and the village of Ayr, so that they can apply for writ of certiorari from the U. S. Supreme Court. The state court recently denied the company a rehearing of the case, in which the Adams County district court set aside sale of the Ayr power plant on the grounds that the power company expended an illegal amount of money in financing the election.

OKLAHOMA—Municipalities in Oklahoma which own their own electric light and power plants must pay a sales tax to the state on light and power sales, the Attorney-General ruled in a recent opinion.

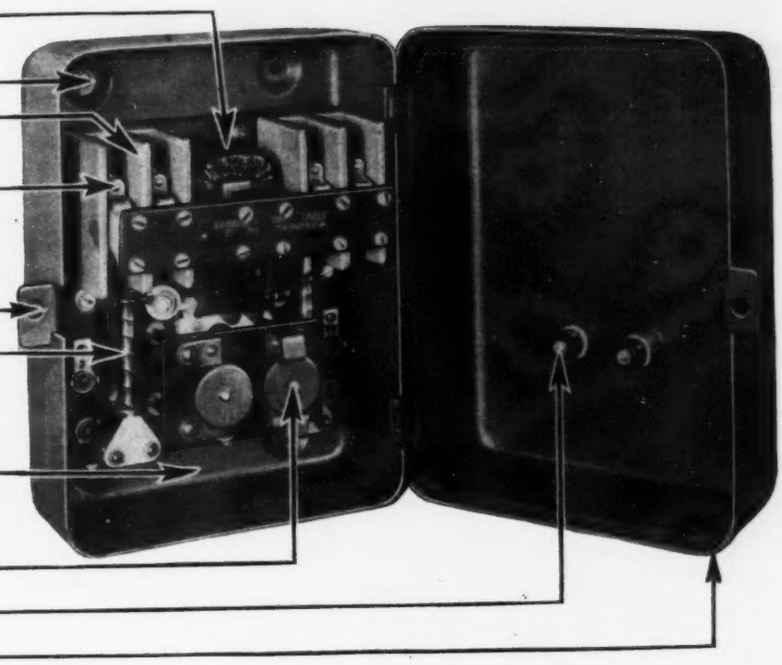
FAYETTEVILLE, TENN.—City has been temporarily restrained by Chancellor Thomas B. Lytle from entering into a contract with T.V.A. or selling $150,000 of power bonds approved in an election September 30. The order was issued in a suit filed by the Tennessee Electric Power Company asking a permanent injunction against the city.

CLARKSVILLE, TENN.—City Council's proposal to float a $250,000 bond issue for municipal power system had approval of voters on October 9. In the referendum the count was 578 to 316 in favor of issuing bonds for funds with which to build a distribution plant. City Councilman Stanley Gower said, however, that plans for construction of the plant probably would be cancelled if the Kentucky-Tennessee Light & Power Company would meet the T.V.A. rate schedule.

WASHINGTON—Voters in Lincoln, Stevens, Okanogan and Pend Oreille counties in eastern Washington will vote November 3 on proposals for establishing public utility districts in those counties under the terms of the 1931 Public Utility Law.

MARION, WIS.—At its recent election the village voted down the purchase of the electric plant from the Wisconsin Power & Light Company by 222 to 140. Three years ago, when the plan was voted on, it passed by a large majority. Through a technical error it was thrown out and ordered to another referendum.

When You Buy **Monitor**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11. Cabinet built of No. 16 gauge cold rolled steel with smooth rounded corners.

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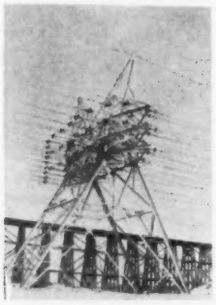

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Values for Insulation Co-ordination

Joint Industry Committee Amplifies Previous Report — New Tables of Flashover for Rod Gaps and Insulators Presented

Work of the joint E.E.I-N.E.M.A. committee on co-ordination of insulation has not been completed, but recently agreed upon values for rod gaps and insulators have been released, as follows, so that they may be followed by the industry pending determination of humidity correction factors, negative wave data, etc. Test conditions have also been defined, as has the term "time zero."

Test conditions

Impulse Tests:

(a) *Wave Form*—The data interchanged among the laboratories was taken with 1x5 and 1.5x40 waves, positive polarity, the first number denoting the time in microseconds from the virtual time zero to crest voltage and the second denoting the time from zero to half valuc on the tail. The data represent minimum impulse flashover values on the tail of the wave.

(b) *Virtual Time Zero*—The virtual time zero is found as follows: Determine points on the front of the wave at 10 per cent and 90 per cent of the crest value. Draw a straight line through these points and the

[*Continued on page* 138]

Table I — Suspension Insulators, Impulse Voltage Flashover, Positive Wave

10-In. Diameter, 5¾-In. Spacing. Barometer, 30-In.; Temperature, 77 Deg. F.; Humidity 0.6085-In. Vapor Pressure

(Data from Allis-Chalmers, General Electric, Locke, Ohio Brass and Westinghouse Laboratories averaged.)

No. of Units	Minimum Impulse Flashover Voltage in Kv. 1x5 ms. Wave	1.5x40 ms. Wave	No. of Units	Minimum Impulse Flashover Voltage in Kv. 1x5 ms. Wave	1.5x40 ms. Wave
1	155	150	11	1,250	1,025
2	285	255	12	1,355	1,105
3	395	355			
			13	1,460	1,185
4	500	440	14	1,565	1,265
5	610	525	15	1,670	1,345
6	715	610			
			16	1,775	1,425
7	820	695	17	1,880	1,505
8	930	780	18	1,985	1,585
9	1,040	860			
			19	2,090	1,665
10	1,145	945	20	2,200	1,745

Tolerances

In accordance with A.I.E.E. Standards No. 41, the comparison should be made on the design and manufacture made in different laboratories. When tests are made in any particular laboratory upon an insulator unit or assembly of specific design and manufacture, the flash-over should be within plus or minus 8 per cent of the value given in the tabulation.

In accordance with A.I.E.E. Standards No. 41, the comparison should be made on the basis of the average flashover obtained from tests on three (3) separate insulator units or assemblies.

Table II — Rod Gap, Impulse Voltage Flashover, Positive Wave

Barometer, 30-In.; Temperature, 77 Deg. F.; Humidity, 0.6085-In. Vapor Pressure

(Data from Allis-Chalmers, General Electric, Locke, Ohio Brass and Westinghouse Laboratories averaged.)

Gap Spacing In.	Minimum Impulse Flashover Voltage in Kv. 1.5 ms. Wave	1.5x40 ms. Wave	Gap Spacing In.	Minimum Impulse Flashover Voltage in Kv. 1x5 ms. Wave	1.5x40 ms. Wave
0.5	22	22	10	233	190
0.75	30	30	15	340	275
1.0	38	38	20	440	350
1.5	51	51	30	640	505
2	60	60	40	835	650
3	76	75	50	1,035	800
4	97	91–95*	60	1,230	945
5	120	106–114	70	1,425	1,095
6	143	128–141	80	1,620	1,240
7	.....	141–155			
8	187	159–166	90	1,815	1,385
9	.....	175–178	100	2,010	1,530

* Dual values are due to unstable conditions, the cause not being known.

Tolerances

These values represent average results of tests made in different laboratories. When tests are made in any particular laboratory using the rod gap as a basis of comparison the flashover voltage shall be taken from the above tabulation and shall be considered as correct within plus or minus 8 per cent.

Table III — 60-Cycle Voltage Flashover Values

Suspension Insulators (10-In. Diameter, 5¾-In. Spacing) and Rod Gaps

Barometer, 30-In.; Temperature, 77 Deg. F.; Humidity, 0.6085-In. Vapor Pressure

(Data from Allis-Chalmers, General Electric, Locke, Ohio Brass and Westinghouse Laboratories averaged.)

Suspension Insulators Flashover Voltage in Kv 60-Cycle Effective		Rod Gaps Flashover Voltage in Kv 60-Cycle Effective	
No. of Units		Gap Spacing Inches	
1	80	0.5	10
2	155	0.75	15
3	215	1	19
4	270	1.5	27
5	325	2	33
6	380	3	45
7	435	4	55
8	485	5	64
9	540	6	72
10	590	8	89
11	640	10	105
12	690	15	150
13	735	20	200
14	785	30	295
15	830	40	385
16	875	50	480
17	920	60	575
18	965	70	665
		80	755
		90	835

Tolerances

Suspension Insulators—These values represent average results of tests on suspension line insulators of different design and manufacture made in different laboratories. When tests are made in any particular laboratory upon an insulator unit or assembly of specific design or manufacture the flashover should be within plus or minus 8 per cent of the value given in the tabulation.

In accordance with A.I.E.E. Standards No. 41, the comparison should be made on the basis of the average flashover obtained from tests on three separate insulator units or assemblies.

Rod Gaps—These values represent the result of tests on rod gaps made in different laboratories. When tests are made in any particular laboratory using the rod gap as a basis of comparison, the flashover voltage shall be taken from the above tabulation and shall be considered as correct within plus or minus 8 per cent.

It should be noted that the sphere gap is the standard for voltage measurements and that the rod gap is to be used only when approximate results will be satisfactory.

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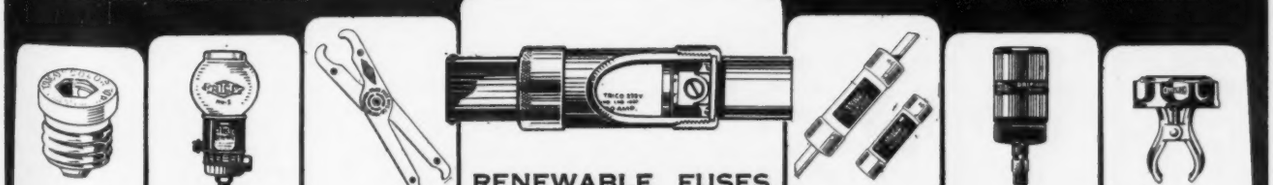

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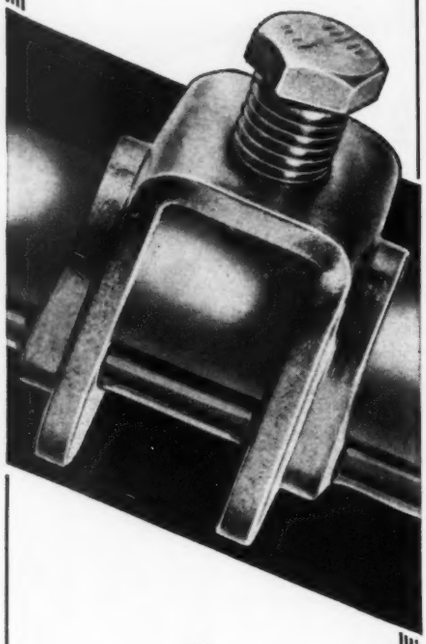

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intersection of this line with the zero voltage line is the virtual time zero.

(c) *Standards and Measurement* — The equipment and methods for producing and measuring impulse voltage are different in the several laboratories. Each group has developed its own calibration and corrections. The subject of impulse testing measurements is to be given further study by an A.I.E.E. committee.

60-Cycle Tests—All the 60-cycle tests were made in accordance with the rules of the A.I.E.E.

Sphere Gap Curves—Whenever sphere gaps were used for voltage measurement the revised calibration curves of Meador and Bellaschi were used. The flashover values tabulated in this report are based on the sphere gap calibrations given in the report of the A.I.E.E. subcommittee of the instruments and measurements committee of the institute, as published on page 783 of the July *Electrical Engineering*.

Accuracy

Impulse Tests—The individual test points from which the curves were obtained in any specific laboratory were within plus or minus 5 per cent of the average curve of that laboratory. The average curves of the several laboratories from which the final averages were obtained had a spread of less than 5 per cent. This statement applies to both the 1x5 and 1.5x40 microsecond waves.

60-Cycle Tests—The individual test points from which the curves were obtained in any one laboratory were within plus or minus 5 per cent of the average curves of that laboratory. The average curves of the several laboratories from which the final averages were obtained had a spread of less than 5 per cent.

On this basis it may be expected that individual points obtained in any laboratory should be within plus or minus 8 per cent of the average curve, for both impulse and 60-cycle flashover tests.

Test results set forth

The average results agreed upon for insulators and rod gaps are given in the accompanying tables. These values, in the opinion of the committee, are of sufficient accuracy to warrant their use for co-ordination purposes and should be used until such time as sufficient additional data are obtained to confirm or modify them.

BOOK REVIEWS

Control of Electric Motors

By Paisley B. Harwood. Published by John Wiley & Sons, Inc., 440 Fourth Avenue, New York City. 390 pages. Price, $4.50.

Engineering supervisor for a control manufacturer, the author has competently assembled the forms of control available in American motor practice and correlated each with the characteristics of d.c. induction, condenser, synchronous and other motors. Chapters are devoted to acceleration, dynamic lowering, braking and pilot device accessories. A moderate amount of design technique and data is included, especially in conjunction with the material on resistor design. Standards, code requirements and field practice are incorporated into the chapter on fabrication and assembly of control apparatus. A final chapter records the basic electronics of control assemblies embracing tubes and photosensitive elements, and then enlarges on the fundamental schemes under which they are utilized. Designers, specifiers, buyers and operators will find nearly equal benefit in the pages.

•

Electric Power Industry in Germany

Issued by the Electrical Division, Bureau of Foreign and Domestic Commerce, Washington, D. C. 22 pages. Price, 10 cents.

Brief but informative, this issue, No. 30 of the series "World Power Manual and Electrical Exporters' Handbook" contains a discussion of the industry in a country where ownership of plants runs the entire gamut from the central government to private corporations, and where one-third the output is generated in plants whose stock is jointly owned by private corporations and the government of the nation or a political subdivision. It presents various statistics of installed capacity and output, supplementing issue No. 2, which appeared about a year ago.

•

A Statistical Survey of Public Opinion

Published by National Industrial Conference Board, 247 Park Avenue, New York, N. Y. 56-page pamphlet. Price, $1.

Replies (3685) to questionnaires to the 10,154 newspaper editors of the country are here tabulated as the thinking of their 17,500,000 patrons on 52 critical questions about the prevailing social-ecenomic issues. Thus, three out of four are found opposed to government competition with power companies. Bureaucratic control of private business is opposed by 92 per cent. Government ownership of electric utilities is opposed by 75.9 per cent of the newspaper circulation. If the news readers are as conservative as their editors think they are, then all will be well with the country.

•

Public Utility Industries

By G. Lloyd Wilson, James M. Herring and Roland B. Eutsler. Published by McGraw-Hill Book Company, 330 West 42d Street, New York City. 412 pages. Price $3.50.

Three professors have here done what seems almost impossible (for professors) to do, namely, to give an expository treatment of the utility industries without propagating pet theories or doing a bit of crusading. This is not a technical book, nor does it dilate on valuation, public relations or the ownership argument. After differentiation of utilities from other businesses and a matter-of-fact discussion of rate making, there are twelve comprehensive chapters on as many types of utility industries telling why they exist, what they do and the major factors affecting the performance.

The electric power chapter traces the origin and evolution of the industry to its present state, noting the major trends of prices, commercial programs, industrial electrication, rural expansion, generation practices. Benefits from interconnection are well enumerated and the holding company era factually analyzed. The recent period of governmental attention to power is adequately described. On the whole, the treatment is as impartial but embracive a portrayal for students of what the power business comprises as could be expected in less than fifty pages. Undoubtedly gas, water, transportation and communication reviewers will find their sections comparable.

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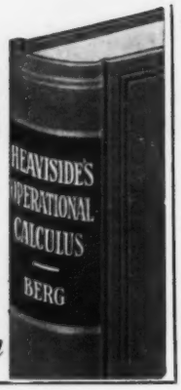

Wilson, Herring and Eutsler's
PUBLIC UTILITY INDUSTRIES

An introduction to the broader problems common to all utilities, presenting first the general nature of the public utility industries, second, a treatment of the organization, functions, services and rate structure of specific industries, and finally, a chapter treating of the trends toward the consolidation and combination of the utilities. 398 pages, $3.50.

Marston and Agg's
ENGINEERING VALUATION

A treatise on the basic principles underlying the valuation of industrial properties, with illustrations of the application of these principles to specific valuations. Included is a synopsis of all the controlling United States Supreme Court decisions affecting the practice of valuation. 655 pages, $6.00.

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RELAY SYSTEMS

Complete treatise on theory and application of relay systems, for design and transmission engineers. Gives practical system of fault calculations for all arrangements of system connections and all types of short circuits. Numerous worked-out examples. 549 pages, illustrated, $6.00.

Berg's **HEAVISIDE'S OPERATIONAL CALCULUS**

A thorough and explicit guide to the solution of complex problems in electromagnetic theory, presenting a competent study and interpretation of Heaviside's simplification of electrical system mathematics. The application of the theory in its relation to electrical practice is clearly brought out and is amplified by diagrams of many of the circuits concerned. The book has been enlarged to include a number of appendices containing various worked-out numerical problems and notes with further explanations of the theory underlying Heaviside's use of the "unit function." 258 pages, illustrated, $3.00.

Croft's **AMERICAN ELECTRICIANS' HANDBOOK**

A thorough revision of this useful handbook for wiremen, contractors, linemen, plant superintendents, construction engineers, and electrical contractors. It gives the facts on apparatus, materials and installation needed by the practical man. 1018 pages, $4.00.

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SALES OPPORTUNITIES IN NEW CONSTRUCTION

CINCINNATI, OHIO—Cincinnati Gas & Electric Company plans extensions in transmission lines for rural electrification and certain urban service in Northern part of Kentucky. Steel towers will be used for high-tension lines over Ohio River and along portion of route in Kentucky, which will include districts in vicinity of Covington and Newport. Project will include distributing lines in different areas, with power substation facilities. Cost about $500,000. Columbia Engineering Company, Fourth and Plum Streets, Cincinnati, is consulting engineer in charge.

GEORGETOWN, S. C. — Southern Kraft Corporation, 220 East Forty-second Street, New York, N. Y., plans installation of motors and controls, transformers and accessories, machine drives, electric hoists, electric pumping machinery and other equipment in new multi-unit kraft pulp and paper mill near Georgetown, where site of about 250 acres of land has just been acquired. A power house will be built. Entire project is estimated to cost close to $7,500,000, and will be placed under way in near future. Completion is scheduled late in 1937. Company is affiliated with International Paper Company, first noted address.

WINCHESTER, ILL.—Illinois Rural Electric Company, Winchester, recently organized, plans transmission and distributing lines in parts of Scott County for rural electrification, totaling about 445 miles, with power substation and service facilities. Fund of $490,000 has been secured through Federal aid. Work is scheduled to begin soon.

WILMINGTON, DEL. — Atlas Powder Company, Delaware Trust Building, plans installation of motors and controls, conveyors, transformers and auxiliary equipment for power substation, loaders, electric hoists and other equipment in new multi-unit industrial chemical manufacturing plant on 160-acre tract of land on River Road, near Wilmington, recently purchased. Entire project will cost close to $1,000,000.

OCILLA, GA.—Irwin County Electrical Association, Ocilla, James Harrell, president, recently organized, plans transmission and distributing lines for rural electrification in part of Irwin County totaling about 140 miles, with power substation and service facilities. Main transmission line will run from Ocilla to Holt, Irwinville, Waterloo and vicinity. Power will be secured from Georgia Power Company. Fund of $140,000 is being arranged through Federal aid.

BROOKLYN, N. Y. — Brooklyn-Manhattan Transit Corporation, 385 Flatbush Avenue Extension, plans extensions and modernization in steam-electric generating plant in Williamsburg section, with installation of turbo-generator units and other equipment for replacements and increase in present capacity. Cost about $4,000,000. Application has been made for permission.

KNOXVILLE, TENN.—Director of Purchases, Tennessee Valley Authority, receives bids until October 28 for winches and towing equipment for locks at Guntersville and Chickamauga dams. Also, until October 30 for steel transmission towers for high-tension line from Norris hydroelectric power plant to Alcoa, Tenn., to operate at 154-kv., requiring about 140 towers. (Connection will be made with lines of Aluminum Company of America, Inc., at last noted place, following recent agreement for exchange of power.)

PAINESVILLE, OHIO—Industrial Rayon Corporation, West Ninety-eighth Street and Walford Avenue, Cleveland, Ohio, plans installation of motors and controls, conveyors, regulators, loaders and other equipment in new viscose rayon mill on 400-acre tract of land in Painesville Township, near Painesville, recently acquired, totaling about 350,000 square feet floor space. A steam-electric power plant will be built for entire power requirements of mill. Cost about $7,000,000. Wilbur Watson & Associates, 4614 Prospect Avenue, Cleveland, are architects and engineers.

FOREST LAKE, MINN. — Northern States Power Company, Minneapolis, Minn., plans transmission and distributing lines for rural electrification in area between Forest Lake and St. Croix, Farmington and Sunrise, with power substation and service facilities.

FORT ATKINSON, WIS.—Will vote on construction of proposed city-owned power plant at general election, November 3, including bond issue for project. Proposed to purchase existing distributing system of Wisconsin Gas & Electric Company and convert for municipal property, with extensions in different districts.

BIRMINGHAM, ALA.—Tennessee Coal, Iron & Railroad Company, Birmingham, a subsidiary of United States Steel Corporation, New York, plans installation of motor-generator sets, transformers and accessories, heavy duty motors and controls, conveyors, loaders, electric traveling cranes, electric hoists and other equipment in new additions to steel mill at North Birmingham, including blooming mill, two continuous cold rolling mills, tinning shop and other mill units. Entire project will represent investment of about $25,000,000 and is scheduled for completion in 1938.

DENISON, IOWA — South Crawford Rural Electric Co-operative Association, care of Emil Wiese, Manning, Iowa, president, recently organized, plans transmission and distributing lines in parts of Crawford, Carroll and Shelby Counties for rural electrification, totaling about 123 miles, including power substation and service facilities. Fund of $127,000 is being secured through Federal aid. Work is scheduled to begin soon.

BROOKLYN, N. Y.—Bureau of Supplies and Accounts, Navy Department, Washington, D. C., receives bids until October 27 for ten knife-type enclosed swtiches and two sets of spare parts, and for five similar switches with one set of spare parts, for Brooklyn and Philadelphia Navy Yards, respectively (Schedule 9075). Also, until November 3, for quantity of portable electric storage batteries and parts for Brooklyn, Philadelphia, Charleston and Mare Island Navy Yards (Schedule 9033).

CHICAGO, ILL.—Kraft-Phenix Cheese Corporation, 400 Rush Street, plans installation of motors and controls, conveyors, loaders, electric elevators and other equipment in new nine-story plant on Peshtigo Court. Cost close to $2,000,000. Mundie, Jensen, Bourke & Havens, 39 South La Salle Street, are architects.

CARROLLTON, GA.—Carroll Rural Electrification Association, Carrollton, recently organized, plans transmission and distributing lines for rural electrification in parts of Carroll County, totaling about 106 miles, with power substation and service facilities. Fund of $118,000 is being secured through Federal aid.